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BACKGROUND MATERIALS ON GOVERNMENT PATENT POLICIES

The Ownership of Inventions Resulting From Federally Funded Research and Development

VOLUME II—REPORTS OF COMMITTEES, COMMISSIONS, AND MAJOR STUDIES

SUBCOMMITTEE ON
DOMESTIC AND INTERNATIONAL
SCIENTIFIC PLANNING AND ANALYSIS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-FOURTH CONGRESS

SECOND SESSION

Serial AAA

AUGUST 1976

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LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C., August 28, 1976.

Hon. OLIN E. TEAGUE,
Chairman, Committee on Science and Technology, House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: I am transmitting herewith a set of selected readings intended to provide our Subcommittee members with an understanding of present government policies concerning patent rights to inventions developed when the primary source for research and development funding is the Federal Government. This Committee print is entitled, "Background Materials on Government Patent Policies—The Ownership of Inventions Resulting From Federally-Funded Research and Development."

Over the years, the Federal Government has developed patent policies on an Agency-by-Agency basis. During several previous hearings held by this Subcommittee, the impact of these policies for patenting and licensing federally-funded R. & D. results have been suggested as a timely subject for review.

I believe that the materials in this report will provide a well-rounded background for our forthcoming hearings. They include the relevant government documents as well as other readings. I commend them to you and the members of the Committee on Science and Technology.

Sincerely yours,

RAY THORNTON, *Chairman,*
Subcommittee on Domestic and International Scientific Planning and Analysis.

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INTRODUCTION

During the current legislative session the Committee on Science and Technology's Subcommittee on Domestic and International Scientific Planning and Analysis has undertaken to fulfill its responsibility of Special Oversight for all non-military funded Research and Development. In the course of this effort a broad range of subjects have been analyzed in Committee Prints, Hearings, and Reports. The Subcommittee has addressed internal R & D coordination and issues of international significance. It is informative that during hearings ranging from International Cooperation in Energy Research and Development to hearings on Federal Research and Development Expenditures and the National Economy a common theme has emerged—the significance of the Government's patent policies in the development of new technologies invented as a result of federally funded research and development.

This is not a new interest for the Committee on Science and Technology. In 1965, the Hon. Emilio Q. Daddario, then a Representative in Congress from the First Congressional District of the State of Connecticut and a Subcommittee Chairman of this Committee reviewed the government patent policies applicable to our national space program. Following the extensive hearings on this subject, Mr. Daddario testified before the Committee on the Judiciary of the United States Senate. He outlined the efforts of the special subcommittee which he chaired and summarized the concerns which are still germane today:

> . . . it is very clear . . . that where federally financed research and development is concerned both Government and the contractor have logical and justifiable equities in the ownership of such patents as may arise in the course of the contract.
>
> It is idle to pretend that the Government, at least in its role of representing the public, has no reason for nor interest in the title to such patents. Without the use of the taxpayers' funds the patent might not evolve in the first place—and the fact that the United States always has a free and irrevocable license to use the patent item or to have it produced by any party it chooses for governmental purposes is not always sufficient to protect the public interest. By the same token, it is equally unrealistic to assert that the contractor, who may have contributed as much or more than the Government in terms of know how and the expenditure of its own money toward the development of the patent, has no claim to ownership nor the exclusive right to utilize the patent for commercial purposes. To take the latter position may be unfair to the large contractor and, in addition, downright disastrous to the small contractor, to whom a patent portfolio is an important asset, both because of the financial support it offers and the protection it gives. This is because, in most cases, doing research for the Federal Government does not of itself assure the contractor of anything like a substantial profit. Our studies showed that in research contracts the profits tend to be 1½ up to 2½ percent. The profit tends to lie with the procurement and or commercial marketing.

The issue of a fair and equitable patent policy; the wisdom of a uniform, government-wide policy; the resultant licensing and procurement practices and other issues have been of continued importance and were evident again in the hearings held earlier this year.

It is to allow the Subcommittee members to conclude this legislative session with a careful scrutiny of this timely subject that the following 3 Part Committee Print was compiled. It contains official government documents, including summaries of individual Agency legislation which demonstrate the present official policies, as well as Presidential messages and resultant regulations which Agencies adhere to in lieu of specific legislative mandates. How these relate to the success of the Nation's R. & D. effort will be the Subcommittee's focus for during a forthcoming series of hearings. The second part of these background papers includes portions of the texts of the important patent policy studies done in the last 30 years, beginning with the Report of the National Patent Planning Commission in 1945, and the 1947 Report of the Attorney General on Government Patent Practices and Policies. The third part includes a selection of scholarly articles on this subject.

REPORT OF THE NATIONAL PATENT PLANNING COMMISSION

GOVERNMENT-OWNED PATENTS AND INVENTIONS OF GOVERNMENT EMPLOYEES AND CONTRACTORS

1945

On December 12th, 1941, President Roosevelt established the National Patent Planning Committee by Executive Order. The purpose of the Committee was to begin planning "for a full utilization of the Nation's expanded industrial capacity with the return of peace." Three reports were issued by the Committee.* The first, in June 1943, and the third, in September 1945, dealt with general patent policy, including the operation of the Patent Office. The second report, issued in January 1945, specifically dealt with Government patent policy. The full text of this fifteen-page report is included in the present report.

*"The American Patent System—Message from the President of the United States Transmitting the Report of the National Patent Planning Commission," House Document 239, June 18, 1943, 78th Congress, 1st Session; "Government-Owned Patents and Inventions of Government Employees and Contractors—Message from the President of the United States Transmitting the Second Report of the National Patent Planning Commission", House Document 22, January 9, 1945, 79th Congress 1st Session; "Third Report on the American Patent System—Message from the President of the United States Transmitting the Third Report of the National Patent Planning Commission", House Document 283, September 6, 1945, 79th Congress, 1st Session.

REPORT OF THE NATIONAL PATENT PLANNING COMMISSION

GOVERNMENT-OWNED PATENTS AND INVENTIONS OF GOVERNMENT EMPLOYEES AND CONTRACTORS

1945

I. Introduction

In its first report on the American patent system, the National Patent Planning Commission directed attention to certain aspects of the general operation of the patent laws. The present report deals with the administration of patents which have come to be owned outright by the Government and also with the respective rights of the Government and its employees and contractors in inventions evolved during the employment or contract relationship. Practically all of the patents normally owned by the Government have come to it through inventions of its employees or contractors, although in many cases the employment or contract relationship does not result in the Government's complete ownership of the patents.

In canvassing the problems presented, an investigation has been made of existing practices in the various Government agencies as set forth in reports by their representatives. The Commission has studied previous legislative proposals, congressional hearings and reports, papers and articles published in trade and law journals and other periodicals, and the practices in some foreign countries. Numerous suggestions by individuals, in and out of the Government, have had consideration. As a result of its studies the Commission has reached the conclusions and recommendations contained in this report.

Until recently, information as to the patents or rights under patents held by the Government was confined to the several Government agencies which acquired them. Realizing that there existed among these and other agencies a need for an adequate central source of information, the Commission recently recommended that a complete record of all rights and interests of the Government in or under patents and applications for patents be maintained in the United States Patent Office. The establishment of such a register was directed by Executive Order No. 9424 of February 18, 1944, and the work of registration is nearing completion. This factual record, however, leaves untouched the questions of policy and administrative procedure to which this report is directed.

The present report does not deal with the enemy-owned patents seized by the Alien Property Custodian. The Commission has consulted with representatives of the Custodian, but has reached the conclusions that the present administration of these patents constitutes a special wartime problem, and that their ultimate management

should receive separate consideration when normal conditions are restored and war problems disposed of.

II. Government-Owned Patents

A. Ownership of Patents by the Government

While the exact number of patents owned by the Government will not be known until the completion of the register of Government interests in patents, it appears the the Government possesses, principally as the result of inventions made by employees, approximately five hundred unexpired patents and that nearly the same number have been expressly dedicated to the public. In addition, there are approximately three thousand unexpired patents of Government employees granted under the Act of 1883 and under which the Government has a royalty-free license.

It is the general practice of the several departments, with respect to patents in their custody, to grant to anyone a nonexclusive revocable license without royalty or other charge. In some instances submission of reports or compliance with certain regulations is required. Owing to the lack of statutory authorization the Government departments do not have the power to grant exclusive licenses or otherwise dispose of patents.

It has been contended that when the Government acquires ownership of a patent, any exclusive rights conferred by the patent disappear and are effectually extinguished; that is to say, the patent in effect becomes cancelled or abrogated by a process of merger when the right to exclude is returned to the authority which originally granted it.

Administrative rulings, however, have held that the Government may own a patent and exercise rights incident thereto since patents are recognized as a species of property. Nevertheless the ownership of a patent by the Government is somewhat anamalous. The chief value and importance of a patent to its owner flow from the right to exclude bestowed by the grant. Being the only person not excluded by the patent from making, using, and selling the invention, the holder of the patent is enabled to profit from the invention by developing his own business, or by licensing others. Commercial and industrial interest in the protection of an operating business or in recovering investment costs requires the exclusive right conferred by a patent, but the Government, not operating a business, has no need for this kind of protection.

The main, if not the sole, purpose of any proprietary interest of the Government in patents has been one of protection against interference with the performance of governmental functions.

Specific statutory power (Act of June 25, 1910, U.S.C. title 35, sec. 68) now authorizes the Government to use any patented invention without license from its owner and thereby renders unnecessary, either during war or peace, the acquisition by the Government of the title to privately owned inventions and patents. However, the Commission recognizes the necessity of making inventions and patents essential to the public health and safety more generally available and made a specific recommendation on this subject in its first report (Sec. III B).

Where inventions have been evolved by the Government itself it should retain the right to use such inventions freely. This protection can be assured by the following methods:

First, by publication of the invention as soon as possible, thus making the information available to all. Prompt and effective publication of the results of Government research is generally a desired objective, except as to matters demanding secrecy for reasons of national defense. In most cases publication of the results of Government research will fulfill its obligation to the public and prevent the issuance of patents to private inventors.

Second, by applying for and obtaining patents. These patents may be entirely owned by the Government or may be expressly dedicated to the public, or on the other hand, may be owned by the inventor who produced the invention, with the Government having the unrestricted right to use it without compensation. The practice of obtaining patents should be restricted to those cases or fields in which the public interest and the protection of the Government would not be entirely satisfied by publication only.

Since the primary interest of the Government in patents is self-protection, its need for them is necessarily limited.

The general policy of the Government in the past has been not to exclude its own citizens from engaging in any commercial or industrial activities; it has not attempted to exercise the right to exclude conferred by the patents which it owns. As a rule, such patents have been open to licensing to anyone who applied, without payment of royalty or other charge and mainly on nominal conditions. Indeed, patents owned by the Government have been open to use by anyone, with or without an explicit license. Furthermore, there has been no attempt to use its patents as a source of revenue. If the Government were to charge substantial royalties for licenses under its patents, it would incur the obligation to sue for nonpayment of royalties and to protect the licenses by suing infringers of the licensed patents. Such controversies between the Government and the public should be avoided. Finally, the Government has not used its patents as a means for controlling commercial activities.

The Commission recommends that the Government as a general rule continue to pursue the historic policy of not exercising the right to exclude conferred by patents which it owns; of not attempting to exclude its own citizens from engaging in any enterprise; of not seeking to derive revenue from patents, and of not undertaking control by means of patents. Inventions covered by patents owned by the Government should be available for commercial and industrial exploitation by anyone, with, however, the recourse open to the Government to take different action in exceptional cases.

B. Extending the Use of Government-Owned Patents

Since the Government can grant only revocable nonexclusive licenses under patents which it owns, it is for all practical purposes restricted to (a) publication, (b) the procurement of a patent which is in terms dedicated to the public and (c) the acquisition of a patent under which nonexclusive licenses may subsequently be granted. It often happens, however, particularly in new fields, that what is available for exploitation by everyone is undertaken by no one. There

undoubtedly are Government-owned patents which should be made available to the public in commercial form but which, because they call for a substantial capital investment, private manufacturers have been unwilling to commercialize under a nonexclusive license. Accordingly, it seems evident that the Government has been handicapped in its effort to further the promotion and development of some of its inventions to the point where they are available to the public in the form of a commercial product. For over twenty years various individuals, committees and boards have called attention to this shortcoming in the Government's management of its patents. One of the clearest statements of the practical difficulties encountered is contained in a letter dated July 30, 1941, from the Under Secretary of Agriculture to the Speaker of the House of Representatives, reading in part as follows:

> In recent years the activities of this Department have developed to such an extent that the present law is inadequate to enable the Department properly to cope with the problems which present themselves in the prosecution of the Department's program.
>
> These problems while they may exist generally throughout the Government service, are of major importance in this Department, due to the varied and extensive nature of this Department's research work and to the fact that this Department must maintain a close relationship with the general public. In carrying out the activities of this Department in the field of research, it is essential that the greatest good should be obtained for the public out of the inventions arising from such research.
>
> One source of difficulty is the fact that, under the present state of the law, the Secretary of Agriculture, when he holds title to a patent, is only authorized to grant licenses which are nonexclusive, nonassignable, and revocable. The commercial exploitation of new inventions requires, in many cases, the expenditure of large sums of money. In such a case, unless some protection or some advantage is given to enable a particular manufacturer to reap a reward as the result of the risk taken by him in investing capital in the new endeavor, he will usually refuse to enter a competitive field. No protection against competition in the commercial development of an invention covered by a patent controlled by this Department can be given to a manufacturer at the present time. As previously indicated, a license to use such a patent is subject to revocation at any time and the licensee must anticipate competition from other manufacturers who, upon request, can obtain similar licenses to use the patented invention. As a result of this, many patents, which are dedicated to the public or controlled by the Secretary of Agriculture, apparently become dormant, even though they possess decided advantages and improvements over the prior art.

Similar statements frequently have been made by high authorities regarding the necessity of protecting venture capital and the utter uselessness of certain potentially valuable inventions in the absence of such protection. Dwight W. Davis, when Secretary of War, stated:

> It has come to the notice of the War Department that the private industries more and more are demanding that patents, the ownership of which is not necessary to the Government interest, be disposed of for the benefit of the public, that is, that the same may be made available to the industries so that the inventions covered by the patents may be practiced and the industries and the general public benefit thereby. The present powers of the President to issue nonexclusive revocable licenses under patents is not adequate to meet this situation, as no industry would deem it prudent to make any substantial investment for the manufacture of a patented article unless assured that its patent rights were irrevocable and also that its competitors would not be granted similar powers as to the same patent. This means that the licenses issued to industries should be exclusive and irrevocable.

Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, in a letter dated October 28, 1941, stated that:

> The principal difficulty lies in the fact that there is now no machinery provided by law under which the patents owned by the Government can be administered

for the best interests of the public. It is not sufficient for a department merely to hold a patent and do nothing, or even to issue licenses freely to all comers; such action in effect often vitiates the intent of our fundamental patent law. A patent needs to be exercised in order to be effective, and many an invention cannot come into commercial use unless the protection thereby afforded makes possible the first hazardous investment which is needed to bring it into useful form. The history of the industry of this country, particularly in regard to the advent of small companies, shows this clearly. Yet, today, when a patent is assigned to the Government, its commercial benefit may be completely lost.

While it is the conviction of the Commission that the Government should continue to adhere to its traditional policy of not engaging in activities which can adequately be conducted by private enterprise, it nevertheless believes that in suitable cases the Government should have the authority and the power to depart from the general policy hitherto followed and, recommended above and take steps to insure the proper commercial development of an invention covered by any of its patents whenever this course is necessary and in the public interest.

The general methods by either of which this may be accomplished are by sale (assignment) of the patent, or by the grant of exclusive licenses. Sale of any patents must be conducted in such manner as to avoid any unfairness or discrimination, as, for example, to the highest bidder in open competition. However, monetary consideration should not necessarily control but proper weight should be given to obligations assumed by the purchaser to assure effective service and benefit to the public.

Similar considerations would apply in the case of exclusive licenses. A license could be made exclusive for a specified period of time only, so that other licenses could be granted on the expiration of the term or it could be made exclusive for a certain geographical area only.

An exclusive license or a sale should be conditioned upon the prompt and proper commercialization of the invention, in default of which the license, or the exclusive nature of the license, would be forfeited, or the ownership of the patent would revert to the Government. The conditions should be such as to insure early use and commercialization of the invention and satisfaction of the public demand at reasonable prices.

Procedure may be devised whereby upon request for an exclusive license or for the sale of a patent an investigation of the circumstances shall be conducted, and notification given to the public to present any objections or to encourage other offers, before any exclusive license is granted or any sale is made.

The Commission therefore recommends that legislation be enacted authorizing the several Government agencies, subject to the approval of the central control body described hereafter, to issue exclusive licenses in cases where it seems evident that otherwise the inventions in question will not come into general use.

Each exclusive license should incorporate the provision that the Government incurs no obligation to assist in the defense of the patent or to undertake the prosecution of infringement suits. Further, the licensee should be enabled to sue in its own name without joining the United States as the owner of the legal title. Such licenses may, depending upon the circumstances involved, be exclusive either on a countrywide basis or only for a certain restricted area so that in the latter case other licenses could be granted in different areas. A license might also be exclusive for a specified period only, or it might be lim-

ited so that, at such time as it shall be shown that the licensee, in addition to realizing a reasonable profit from his manufacturing operations, has in fact or in effect fully amortized his investment, the exclusive license may be terminated and nonexclusive licenses made available to the general public.

The last condition mentioned contemplates a procedure whereby the original manufacturer will receive the protection essential to his exploiting of the invention, but does not permit him to reap excessive profits for the remaining life of the patent. Indeed, the larger his profit, the sooner the licensee may lose his exclusive license, since all profit over and above that deemed reasonable by the Government may be applied to amortize the investment, thereby accelerating the expiration of the license.

The Commission has likewise considered the final alternative of the sale of patents and, as previously indicated, has concluded that under certain circumstances this may prove desirable. *The Commission therefore recommends that the legislation proposed should also empower the Government agencies, subject to the approval of the central control body, to sell (assign) patents when it is evident that the offering of an exclusive license will fail to insure satisfactory exploitation.*

These recommendations with respect to the granting of exclusive licenses and the sale of patents are made not with the view that these practices should become commonplace, but, on the contrary, that they should be followed only in exceptional cases as the last resorts to be considered. The Government should ordinarily make its inventions available to the public by publication or by patents which are generally open to public use.

The Commission believes that the Government should not attempt to utilize its patents for profit; they should not be regarded as a money-making venture. The main objective should be to insure that the invention is brought into commercial channels at the earliest possible moment. It is believed, however, that there should be no objection to recovery by the Government, through sale or licensing, of all or a substantial part of public funds expended in the research which resulted in the invention.

The suggestion has been made to the Commission that such money as may be collected be allocated to the respective agencies in which the inventions originated, as special funds for research and awards to employee-inventors. The Commission, however, believes that these funds should not be automatically credited to the agencies, but that governmental research activities in general should continue under the Congressional scrutiny and control provided by existing appropriation procedure.

III. Inventions of Government Employees

In normal times the principal source of inventions and resulting patents in which the Government may have a proprietary interest is its own research work, and various problems arise in connection with inventions made by its employees, both research employees and others.

A. Law Relating to Inventions Made by Employees

Under the Constitution and the patent laws the Government is limited to the granting of patents to inventors and the patent cannot be issued or conveyed to another except by consent or agreement of

the inventor. Consequently a patent for an invention always belongs to the inventor and must be granted to him unless he has previously agreed to its transfer. However, the courts, in certain situations, assume an agreement to exist. If the employee is specifically hired or assigned to develop a particular invention, its ownership and that of the patent may be asserted by the employer. In all other cases the invention and patent will belong to the employee, although under some circumstances the employer may have certain rights. The employer may be entitled to a non-exclusive license or shop-right—that is, the right to use the invention, if it is within the general field of the employee's research or inventive work or if it was produced on the employer's time and by the use of his facilities. Under other circumstances the employer has no right or legal interest in the invention or the patent. These three categories are variously expressed and the lines of demarcation between them are not always clear.

The Supreme Court, in the case of United States vs. Dubilier Condenser Corp., decided in 1933, stated the general law to be that one who is employed to make an invention is bound to assign to any patent obtained to his employer. On the other hand, if the employment is general, although it covers a field of labor and effort in the performance of which the employee conceived the invention, assignment of the patent is not required. In illustration of the latter proposition, the Court quoted from one of its earlier decisions in which it had held that a manufacturing corporation which hired a skilled workman to take charge of its works and to devote his time and services to devising and making improvements in articles it manufactured, was not entitled to the ownership of patents obtained for inventions made by the employee while so employed, in the absence of an express agreement to that effect.

The Supreme Court also decided in the same case that the relationship of the Government to one of its employees with respect to inventions made by the latter is the same as the relationship between any private employer and employee. Hence in the absence of any specific agreement the rights to an invention made by a Government employee are determined by the general rules referred to.

Many private employers stipulate in the employment contracts the allocation of patent rights.

B. Statutes Relating to Inventions Made by Government Employees

There are no statutory provisions preventing the patenting of inventions by Government employees, except in the case of employees of the Patent Office who, by statute first enacted in 1836, are prohibited from acquiring any right or interest (except by inheritance or bequest) in any patent issued by the Office, and are hence barred from patenting or attempting to patent, while so employed, any inventions they may have made.

An Act of Congress passed March 3, 1883 (22 Stat. 625) and amended on April 30, 1928 (45 Stat. 467) provides that, under certain conditions, a patent may be granted to a Government employee without the payment of any fee. These conditions are, first, that the head of the department certify that the invention is or may be used in the public interest and, second, that the invention may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty. This Act does not regulate or control

the respective rights of the Government and the employee, and, insofar as the statute is concerned the obtaining a of patent in accordance with its provisions is entirely voluntary.

The fees referred to in the Act are those payable in obtaining a patent. In actual practice, when a department is interested in an invention and certifies as required, it undertakes the preparation and prosecution of the patent application, so that the employee is not put to any expense in connection with the patent. The obtaining of a patent without expense is an inducement to employees to offer the Government a free license in instances in which they might not be obligated to do so.

The Act of June 25, 1910 (36 Stat. 851), amended July 1, 1918 (40 Stat. 705), relates to the use of patented inventions by or for the Government, without license from the owner, and provides that the owner may sue for compensation in the Court of Claims. However, the benefits of the Act are declared not to apply to any patentee who is in the employment or service of the Government when he makes the claim nor to any invention made by a Government employee. Thus a Government employee is barred from suing the Government for use of any patented invention.

The Act does not regulate the respective rights to an invention made by an employee other than to deprive the employee of a right to sue, and it does not prohibit or prevent Government departments which may otherwise have the power to do so from contracting with or compensating inventors for the use of their inventions. However, since an employee is barred from any remedy, the Government under this Act may effectuate a free license to use any invention made by an employee.

The section of the patent laws relating to the abandonment of an application for patent by reason of the applicant's failure to prosecute the same within six months from the date of an action by the Patent Office (section 4894 R. S.) contains an exception in favor of applications which have become the property of the United States. If the head of the department certifies that the invention is important to the armament or defense, the reply to an action by the Patent Office need not be made for three years. This effective three-year suspension, which may be repeated as often as necessary, is used by the departments as the means for preserving an invention in secrecy when the nature of the invention so requires.

C. General Practices of the Government Departments With Regard to Inventions by Employees

A number of Government departments have issued regulations dealing with inventions of their employees. With minor exceptions these departments expect or require that inventions made within the specifically assigned duties of the employee shall be assigned to the Government, in conformity with the decisions of the courts regulating the matter in default of specific agreement. The departments generally assert no rights in inventions made by an employee on his own time, without the use of Government facilities, and in a field unrelated to his employment, except as may be voluntarily granted by the employee. In situations other than these two the general rule is that the invention and the patent belong to the employee in the absence of a specific agreement to the contrary, although the employer may have the right to use the invention without payment of a royalty. Some

departments follow this general rule, while others require assignment of the patent in cases where the invention is closely related to the duties of the employee and the work of the department.

In general, when research is conducted primarily for the benefit of the public as a whole, Government agencies tend to permit retention of private commercial rights by the employee in a smaller proportion of cases than when the research is aimed at improvement of governmental functions and operations. In the latter cases the direct needs of the Government are completely met by its freedom to make and use any invention which may result, or to have the invention made and used for governmental purposes, without payment of royalties or any restrictions.

Close control and suitable provisions for maintaining secrecy are enforced in connection with inventions of a military nature which must be kept secret in the interests of national defense.

Except in the case of inventions requiring secrecy the departments are not generally concerned with patents which their employees obtain in foreign countries, and the matter is ordinarily left entirely with the employee.

Various departments of the Government have arrangements whereby employees who make valuable suggestions resulting in benefit to the Government are given some reward or special recognition similar to the award systems of private employers. These plans are not limited to ideas of the type capable of resulting in patentable inventions and find their greatest success and value in the field of small improvements promoting economy and efficiency.

D. Policy Regarding Inventions of Government Employees

In the absence of legislative compulsion, such uniformity in policy and practice as exists between the several Government agencies results from recognition of the common law. Two principles, established by numerous court decisions, which operate in the absence of a contract to the contrary are:

(a) Inventions made within the specifically designated duties of the employee shall be assigned to the employer since he has only produced that which he was employed to invent;

(b) Inventions made by an employee on his own time, without the use of his employer's facilities, and in a field unrelated to his employment, shall be the exclusive property of the employee, who shall be entitled to all patent rights.

These principles are so equitable, so firmly established in the common law, and relatively so readily susceptible to administrative adoption and enforcement, that *the Commission recommends they be made uniformly applicable throughout the Government service.*

It is in the area not covered by (a) and (b) above that the least uniformity exists in Government practice because of the many variables involved. Within this area it does not seem practicable to devise a uniform law or order which could equitably apply to the many combinations of circumstances which can, and do, arise. The conditions of employment under which the inventions may be developed; their relationship to Government work; the character of the contribution of the inventor; the needs of the agencies and of the Government as a whole, and the probable contribution to the public welfare—all are variable factors, and a great degree of flexibility is necessary. Accord-

ingly, the Commission concludes that it should be left to the agencies initially to determine the action which will best serve the interests of the public, the Government as represented by the agency, and the encouragement of inventiveness by the employees. *The Commission recommends, however, that policies and regulations adopted by any agency be submitted to a central control body for approval before they become effective, and that this body also serve as an appellate tribunal with power of final decision as regards appeals which employee-inventors may desire to take from agency decisions.*

The proposal that employee-inventors be granted special awards for unusually meritorious services is regarded with favor by the Commission, but is it of the opinion that it would not be judicious to introduce such a system by blanket order or to make it dependent upon any particular fund. Any agency which is genuinely interested in an award system should negotiate for it in the regular manner, first consulting with the Bureau of the Budget, which has collected useful information on this subject, and next justifying the resulting proposal before the appropriate Congressional committees: *The Commission recommends that agencies which qualify under this procedure should be authorized independently to make individual awards up to a specified amount, awards above this amount and up to a specified maximum to be approved by the central control body.*

IV. Government Sponsored and Aided Inventions

A considerable amount of governmentally subsidized research in connection with the war is now being conducted by educational institutions and by private concerns under Government contracts. The Government also sponsors research during times of peace but on a more limited scale. There is no way of calculating how many patents will result from war research, nor what proportion of the inventions will have application outside of purely military fields.

Inventions made by Government contractors working on research and development contracts present important, and sometimes difficult, problems. The time, circumstances, and conditions under which the Government makes contracts for the pursuit of research or development work by private agencies vary greatly. The contract may be on a profit or nonprofit basis, and, if the latter, the Government may bear all or part of the expenses involved. The contractor may be an educational institution, or may be an industrial firm or corporation. A particular contractor may be selected because of an accumulation of knowledge, experience, and special facilities of peculiar value in a certain field. Existing private research facilities may be utilized, thereby avoiding their duplication by the Government at considerable expense. In some instances the effort involved may be only a further development and refinement of work already done by the contractor, while in others the contractor may be breaking entirely new ground.

Under these varying conditions patent rights resulting from Government-sponsored research have been disposed of in accordance with any of the following methods:

1. The Government has retained the blanket power to determine at its discretion the disposition of all patentable discoveries or inventions which may be made under the contract.

2. The Government has taken complete ownership of patents which may result, with a license back to the contractor.

3. Ownership of patents has been left with the contractor, while the Government receives a royalty-free license.

4. Ownership of patents has remained in the contractor, with the Government receiving, in addition to a royalty-free license, the power to require the licensing of others.

A common feature of the several types of contracts mentioned is a clause by which the Government has the option of obtaining licenses on reasonable terms under patents for inventions relating to the subject of the contract, which the contractor may have made before the contract was entered into.

It has been urged with considerable theoretical justification that there should be a uniform patent clause in all Government research and development contracts. The Commission has concluded that a single uniform practice would be unfeasible and undesirable from the standpoint of the Government. The ownership of inventions resulting from such contracts cannot be fairly determined by an arbitrary or fixed rule but should be established in each situation in accordance with the applicable circumstances. The Commission believes, however, that, since the Government has no need of the right to exclude conferred by a patent and does not enter into ordinary commercial enterprises in competition with its citizens, full ownership of patents should not ordinarily be asserted by the Government. An exception to this policy would be the situation in which private ownership of the patents would conflict with national interest. In those cases in which the Government does not acquire ownership of the patents, it should ordinarily receive as a minimum a royalty-free license. All negotiations in connection with research and development contracts, as well as the drafting of the contracts themselves, should be performed as now by the agencies involved.

V. Control Over the Administration of Government Patent Policies and Practices

Up to the present, the absence of any form of central control over the patent policies and practices of Government agencies has probably not been of special significance because of the lack of any substantial, clearly defined authority to take affirmative action. But with the adoption of the more positive policies and practices advocated by the Commission, the establishment of a central body vested with certain authority to review and approve important agency proposals becomes almost essential.

A central control body should therefore be created to perform the following functions:

1. To prepare, promulgate, and enforce such general policies concerning the administration of Federal intragovernmental patent matters as may be uniformly applicable and desirable, subject to the approval of the President of the United States.

2. To review and approve all existing or proposed agency policies and regulations relating to the acquisition of inventions and patents evolved by Government employees.

3. To serve as an appellate tribunal with final powers of decision as regards any disputes which may arise between employee-inventors and their respective agencies.

4. To approve such individual cash awards exceeding a specified amount which agencies may propose to give to their inventor-employees.

5. To review and give prior approval to any action which any agency may propose to take with respect to patents owned by the Government.

6. To serve the agencies as an educational, advisory and consultative medium, and as a clearing house for the interchange of information and plans. Appropriate studies and investigations could be conducted from time to time with the purpose, for example, of determining the actual extent of utilization of Government-owned patents and the most effective ways of handling special problems. By keeping informed of changing conditions and developments in Government patent matters the central body would be in a position to determine the need for executive action or for legislation.

The Commission recommends the establishement of a central control body empowered to perform the indicated functions.

The central control body should be composed of men of known and outstanding ability and should be independent of any existing Government agency whose functions and activities might reasonably be expected to result in inventions. After careful consideration the Commission is led to the conclusion that the central control group should be placed under the Executive Office of the President, preferably within the Bureau of the Budget and under the supervision of the Director.

VI. Summary of Major Conclusions and Recommendations

1. Enemy-owned patents seized by the Alien Property Custodian are outside the scope of the present report. The ultimate management of these patents should be left until the return of normal conditions and the disposal of war problems.

2. The general policy of the Government should be that of making its patented inventions available for commercial and industrial exploitation by anyone, but the Government should have the power to grant exclusive licenses or otherwise dispose of patents under appropriate conditions and safeguards whenever it is determined that such action is necessary to assure the commercial development of an invention of a Government-owned patent.

4. The ownership of inventions resulting from research contracts cannot be determined in advance by an arbitrary or fixed rule but must be decided in each instance in accordance with the facts involved.

5. There should be a central control body, in the Executive Office of the President, having the following principal powers, functions, and duties:

(*a*) Promulgating general policies and supervising and approving departmental policies regarding employee inventions, and determining disputed cases.

(*b*) Supervising and approving the manner of disposing of patent rights by the individual departments, including granting exclusive licenses and selling Government-owned patents.

(*c*) Instructing and advising departments and agencies, collecting information, conducting investigations, and making appropriate recommendations.

INVESTIGATION OF GOVERNMENT PATENT PRACTICES AND POLICIES

REPORT AND RECOMMENDATIONS OF THE ATTORNEY GENERAL TO THE PRESIDENT

(The Attorney General's Report)

1947

In 1947 the Attorney General of the United States submitted a comprehensive, 3-volume report to the President entitled "Investigation of Government Patent Practices and Policies." The need for the report arose from the Government's large research and development program during World War II, and the observation that patent policies of the many agencies and departments engaged in the war effort differed noticably. The Introduction, the "Summary of Findings, Conclusions and Recommendations of the Attorney General," and Chapter I "The Patent Aspects of Government Research" are included here.

INVESTIGATION OF GOVERNMENT PATENT PRACTICES AND POLICIES

REPORT AND RECOMMENDATIONS OF THE ATTORNEY GENERAL TO THE PRESIDENT

1947

Introduction

This investigation was initiated by the following letter dated February 5, 1943, from President Franklin Delano Roosevelt to Attorney General Francis Biddle:

My Dear Mr. Attorney General: There appears to be need for a uniform Government-wide policy with respect to the ownership, use or control of inventions made by employees of the Federal Government, or by employees of Government contractors in the course of performing contracts financed by the United States.

I should like you to make an investigation of the present policies and practices of the several departments and agencies under regulations, agreements or otherwise, and to submit to me your recommendations as to a uniform policy for the entire Government. In the course of this investigation, will you confer with and obtain the views of the other Departments and agencies, and examine such data and records as they may have which are pertinent or applicable to your investigation.

Very sincerely yours,

Franklin D. Roosevelt.

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THE PROCEDURE

The basic data underlying this study consist of the documentary records, and the official views and experience, of the several establishments of the Government whose functions include scientific research and development, or the administration of patents. All relevant files and records, to the extent available, were obtained from the agencies themselves and from the National Archives. Extensive interviews were conducted by members of the staff with the key officials in each agency, both at the policy-making and at the operational levels, in order to ascertain and appraise, from the standpoint of actual experience, the merits and effectiveness of current and prior practices and policies. These materials were collated and analyzed, and from them was prepared a draft Monograph describing the patent practices and policies of each Government agency concerned, their historical development, the experience gained therefrom, and the opinions of familiar with their operations.

A similar but less exhaustive inquiry was made into the patent practices and policies (insofar as they related to inventions of employees or contractors) of the governments of the 10 leading industrial foreign countries, and of about 75 nongovernmental research organizations in this country, including educational institutions, other non-

profit research groups, and industrial laboratories. This material was likewise analyzed and summarized in draft Monographs. Finally, draft Monographs were prepared dealing with the pertinent legal principles, and summarizing the numerous studies, proposals and recommendations made in this field by the executive and legislative branches during the past 50 years.

A First Report of the Attorney General was then prepared, embodying tentative findings, conclusions and recommendations of Attorney General Biddle, based upon the data summarized in the 19 draft Monographs. The First Report, together with the draft Monographs, was submitted to President Harry S. Truman on August 2, 1945, marking the close of the first phase of this study.

The First Report and the draft Monographs on the several agencies were then mimeographed and, with the President's consent, widely distributed throughout the Government for comments, criticism and suggestions. The draft Monographs on institutional and industrial research organizations were distributed to those mentioned therein for comments, criticisms and suggestions. The part of the draft Monograph dealing with the most relevant foreign experience, that of Canada and Great Britain, was submitted to their officials for review and comment.

Replies were received to virtually every inquiry, often containing suggestions and additional data and experience of a more recent nature. The final Monographs were then prepared, incorporating to a very large degree the suggestions made by the Government agency, the foreign government, or the private organization concerned.

The replies received from a number of agencies to the First Report of the Attorney General reflected the lack of uniformity in the patent policy of the several Federal agencies which had been noted in President Roosevelt's letter of February 5, 1943. Some approved the tentative conclusions and recommendations contained in the First Report, in whole or in part; others took exception thereto in varying degree. The substance of these replies is summarized in the Monograph on Prior Studies, Vol. III, pp. 300–310, and has been given careful consideration herein. The collection of data was concluded in 1946, so that the Report and Monographs do not reflect any information or experience subsequent to that time.

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Final Report of the Attorney General to the President

Patent policies and practices of Government departments and agencies relating to inventions of their employees and contractors

I have the honor to submit my Final Report of the investigation which the Department of Justice undertook at the request of President Franklin Delano Roosevelt in 1943, dealing with the patent policies and practices of the several departments and agencies of the Government concerning inventions made by their employees and contractors.

This Final Report consists of the Report Proper and 19 separate Monographs. The Report Proper summarizes past and current practices, presents my findings and conclusions, and submits my recom-

mendations for a uniform patent policy for the Government of the United States. The Monographs incorporate or summarize the vast body of data collected in the course of the investigation, and consist of a Monograph on the relevant principles of law; a Monograph describing prior studies of this and related subjects during the last fifty years; 14 Monographs on the patent policies and practices of each Federal department and agency which is concerned with the instant problem; a Monograph on the governmental patent practices of the 10 most industralized foreign countries; a Monograph on the patent practices of more than 50 educational and nonprofit organizations in the United States; and a Monograph on the patent practices of the leading industrial laboratories in the United States. The Report Proper is contained in Volume I of this Study, while the Monographs are incorporated in Volumes II and III.

The size of this Final Report calls for handy summaries. Each of the 17 Monographs dealing with the patent practices and policies of governmental and nongovernmental organizations therefore contains a summary of its contents. There follows a summary of the Report Proper, briefly describing my findings, conclusions and recommendations.

Summary of Findings, Conclusions, and Recommendations of the Attorney General

I. Patent Aspects of Government Research

The research and development activities of the Government have mirrored our national history, concentrating on military science in revolutionary times, expanding to meet the needs of agriculture, public health and other fields in the nineteenth century, and sky-rocketing during the past five years into a multi-billion dollar program concerned primarily with aviation, transportation, communications, ordnance and atomic energy. Federal participation in postwar research will be large and of major significance. The fruits of this great national resource are advances in science and technology, usually susceptible of civilian as well as governmental uses; and since many of these advances consist of patentable inventions, their use and enjoyment by the Government and by the people of the United States may depend upon the control of patent rights.

This Study has sought the answer to the following inquiry: What disposition of patent rights as between the Government, its employee or contractor, and what use of patent rights owned by the Government, will best serve the public welfare and stimulate the progress of science and the useful arts?

II. Inventions Made By Government Employees

A. findings and conclusions of attorney general

Inventions financed with public funds should inure to the benefit of the public, and should not become a purely private monopoly under which the public may be charged for, or even denied, the use of technology which it has financed. The weight of informed opinion and the evidence of experience establish that the ownership of patent rights is not a necessary form of incentive to the great majority of

Government scientists and technicians. Such opinion and experience further establish that patent rights are in fact an undesirable form of incentive because they may induce lack of cooperation and secretiveness among research workers; may unduly emphasize the patentable phases of their work; would provide an unequal form of reward for performance of comparable merit and usefulness; and would permit public-financed technology to be suppressed, used restrictively, or made the basis of an exaction from the public to serve private interests.

B. RECOMMENDATIONS OF ATTORNEY GENERAL

1. The Government should obtain all rights to inventions made by its employees (i) during working hours, or (ii) with a substantial contribution by the Government (in the form of facilities, equipment, materials, funds or information, time paid for by the Government, or services of other Government personnel), or (iii) bearing a direct relation to the employee's official functions.

2. In other cases, where there is some contribution by the Government, or some relationship between the invention and the employee's official functions, but where these are clearly insufficient to warrant the assignment to the Government of all rights in the invention, as determined by the Government agency concerned, with the approval of the Government Patents Administrator (the head of the central agency which this Report recommends be established to administer the Government's patent policy), ownership of the invention should be left to the employee, subject to a nonexclusive, irrevocable, royalty-free license to the Government to make, have made, use and dispose of the invention, and also subject to the obligation on the part of the inventor or his assignee to exploit the invention diligently or to grant nonexclusive licenses thereunder at a reasonable royalty to all applicants.

3. In all other cases, the Federal employee should retain all rights to his inventions, subject to existing provisions of law. At the inventor's election, the Government may undertake to patent the invention free of any charge to the inventor under the Act of 1883 as amended, subject to the governmental license provided for therein.

III. Rewards to Employees

A. FINDINGS AND CONCLUSIONS OF ATTORNEY GENERAL

1. Any system of special financial rewards, promotions or salary increases to employees on account of their making a patentable invention or discovery is undesirable because, by offering a premium to the employee who produces the invention, it may induce secrecy and lack of cooperativeness on the part of research and technical employees; it will involve administrative difficulties of selecting the person to be rewarded whenever the invention was the result of group endeavor; it may create dissatisfaction among unrewarded members of a research group as well as among personnel assigned to functions not likely to produce a patentable invention; and it may lead the employee to slight or ignore such functions.

2. A general system of cash bonuses, promotions and salary increases for meritorious suggestions or ideas, regardless of whether

they are patentable or not, would be free of these objections and may tend to remedy any inadequacies in the salary structure.

3. A valuable form of incentive and reward for outstanding scientific contributions and suggestions within the Government would be public, official and professional recognition of meritorious contributions.

B. RECOMMENDATIONS OF ATTORNEY GENERAL

1. The establishment of a system of cash bonuses, promotions and salary increases for scientific or technological suggestions or contributions should be left to the initial determination of each Federal agency, but as a matter of basic Government policy, no system should be maintained within any agency which in terms or in practice is limited to or emphasizes the patenable invention, or which offers greater reward for an invention than for any other type of scientific or technological suggestion or contribution. Any reward system should make adequate provision for entire research groups or teams producing valuable scientific advances.

2. A system should be established, under the direction of the Government Patents Administrator, to provide for public, official and professional recognition of meritorious scientific contributions and advances by Federal employees, through the issuance of certificates of merit by the President or the head of the Federal agency, announcements to the press, articles in scientific periodicals, and other forms of recognition.

3. All Government agencies adopting a system for rewarding valuable scientific or technological suggestions and contributions should report the operations and success of the system periodically to the Government Patents Administrator, who should correlate the experience of each agency, and inform, advise, and make recommendations from time to time concerning the operation and improvement of the system.

4. A survey should be made of the Government salary scale for scientific and technical personnel, in order that such upward revisions should be made as may be warranted by the recent rise in the cost of living and other pertinent factors.

IV. Inventions Made By Government Contractors

A. FINDINGS AND CONCLUSIONS OF ATTORNEY GENERAL

1. Where patentable inventions are made in the course of performing a Government-financed contract for research and development, the public interest requires that all rights to such inventions be assigned to the Government and not left to the private ownership of the contractor. Public control will assure free and equal availability of the inventions to American industry and science; will eliminate any competitive advantage to the contractor chosen to perform the research work; will avoid undue concentration of economic power in the hands of a few large corporations; will tend to increase and diversify available research facilities within the United States to the advantage of the Government and of the national economy; and will thus strengthen our American system of free, competitive enterprise.

2. To leave patents rights to the contractor may permit the suppression of an invention paid for by the public, or the imposition of an assessment for its use by the public to serve private advantage. It would constitute an unequal form of reward for comparable performance, and would tend to unbalance Federal research by making more desirable those aspects likely to lead to commercially valuable patent rights.

3. Expert opinion and experience within and without the Government support the conclusion that a policy of public ownership of inventions made under Government contract would be acceptable to a sufficient number of competent private and institutional laboratories to make it workable. However, exceptions to the basic policy should be allowed where necessary in emergency situations, to permit the contractor to retain the patent rights to inventions to which he has already made a substantial independent contribution; but in all such cases the Government should obtain at least a free license under the resulting inventions and should prohibit their suppression or the assessment of unreasonable charges for their use by others.

4. The weight of evidence is that the policy recommended herein will not substantially increase the costs of Government research contracts, nor diminish the efforts of the contractor's organization to perform the work competently. To the extent that extra costs may result from the recommended policy, they would be fully justified by the advantages of making publicly-financed technology broadly and freely available.

B. RECOMMENDATIONS OF ATTORNEY GENERAL

1. As a basic policy, all contracts for research and development work financed with Federal funds should contain a stipulation providing that the Government shall be entitled to all rights to inventions produced in the performance of the contract.

2. If the head of any Government agency certifies, with the approval of the Government Patents Administrator, that an emergency situation exists requiring that an exception be made to the basic policy in a particular case in respect of prospective inventions to which the contractor has made a substantial independent contribution prior to the award of the contract, such exception may be made, upon such terms and conditions as the Administrator may prescribe or approve. Every such exception should, to the extent possible, be subject to the following conditions:

(*a*) The head of the agency concerned should certify, with the approval of the Government Patents Administrator, that he has made a reasonable effort to enter into a contract for the research or development work in question with a qualified organization in accordance with the Government's basic patent policy, but has been unsuccessful.

(*b*) The contract as awarded should stipulate that the contractor will be permitted to retain patent rights only to inventions which involve a substantial independent contribution by the contractor or his staff antedating the work called for in the contract, as determined by the head of the agency with the approval of the Government Patents Administrator, or, in appropriate cases, by arbitration.

(*c*) The contractor should grant the United States a nonexclusive, irrevocable, royalty-free license, to make, have made, use and dispose of any inventions awarded to him under the contract.

(*d*) The contractor (or his assignee) should agree to place the invention in adequate commercial use within a designated period; and if at the end of such time the Government determines that such use is not being made, the contractor (or his assignee) should be required to offer nonexclusive licenses at a reasonable royalty to all applicants.

3. Cooperative research projects shall also be subject to the basic patent policy, but the head of the agency concerned, with the approval of the Government Patents Administrator, may make an exception to this policy in a particular case when a proper showing of the need therefor has been made; provided, however, that the conditions of section 2 above shall be observed to the extent feasible.

4. To the extent permitted by law, grants of Federal funds for research or development work which may result in patentable inventions should be subject to the same patent policy as pertains to research and development contracts.

V. Administration of Government-Owned Patent Rights

A. findings and conclusions of attorney general

1. The public interest will best be served by opening Government-owned inventions to general public use, without discrimination or favoritism among users.

2. While opinions vary, the weight of experience is that Government-owned technology can for the most part be exploited to a satisfactory extent under a system of nonexclusive licensing or public dedication. In the occasional situation where the commercial use and exploitation of worth-while inventions is discouraged by the need for a substantial investment in promotional developmental and experimental work, with the attendant risk or loss, the Government should finance such operations, in whole or in part, to demonstrate or prove the commercial value of the invention. This method of encouraging the use of the invention is preferable to the grant of an exclusive license.

3. The issuance of exclusive licenses under Government-owned inventions presents the difficulties of selecting one out of numerous applicants (for which purpose competitive bidding is undesirable and unsuited), policing the licensee's operations, and detecting and prosecuting infringers. The outright sale of an invention would deprive the Government of control over its use, and would permit its suppression or the exaction of an unreasonable charge for its use by the public. Moreover, the price received by the Government for the invention is apt to be far less than the ultimate cost to the public of using it.

4. As general rule, the licensing of Government inventions on a royalty basis is objectionable because it may be difficult to fix a royalty which will be fair to all; it will necessitate detecting and prosecuting infringers; and it involves the imposition upon the public of a charge for the use of technology paid for with public funds. The financing of research by general taxation appears to be a simpler and more equitable method.

5. The licensing of Government inventions under conditions relating to the use of the invention or its resulting product is likewise objectionable as a general rule, because it will require policing of the licensee's operations, and the detecting and prosecution of infringers.

Control over the use of the invention or its product may more effectively be imposed by other means.

6. Patenting of Government inventions affords greater protection than publication of the unpatented invention, and permits controls to be imposed in appropriate cases upon the use of the invention.

B. RECOMMENDATIONS OF ATTORNEY GENERAL

1. As a basic policy all Government-owned inventions should be made fully, freely and unconditionally available to the public without charge, by public dedication or by royalty-free, nonexclusive licensing.

2. As soon as an invention is completed under circumstances giving the United States the right to any patent rights therein, it should be covered by a patent application, unless the head of the agency finds that adequate protection of the public interest may be had by reducing the invention to practice, publishing it, and fully disclosing it to the Patent Office in such form as to make it a part of the prior art.

3. All inventions and patent rights now owned or controlled, or hereafter acquired, by the United States or any agency thereof, corporate or otherwise, should be listed in the register of Government patent rights in the United States Patent Office, and copies or abstracts thereof should be freely distributed to Government agencies, public libraries, universities, trade associations, scientists, industrial and commercial organizations, and other interested groups and persons.

4. To the extent that funds are or may be made available for the purpose, projects should be inaugurated by the interested Government agencies under the supervision of the Government Patents Administrator, to demonstrate and publicize promising inventions at key industrial and scientific centers, in order to inform and interest business and science, and particularly small business, in their use or development and to eliminate any obstacles to their successful exploitation. Similar publicity should be given to scientific and technical information of an unpatentable nature, acquired by the Government.

5. If the Government Patents Administrator or any other Government agency believes that the commercial use and exploitation of a promising invention would be aided by preliminary experimental, developmental or pilot-plant operations to establish its practicality or effectiveness, the Government Patents Administrator may recommend such projects to the appropriate Government agency or to Congress for adoption.

6. The Government Patents Administrator should prepare and submit to the President for approval a program to encourage and sponsor the use and practice of Government-owned inventions by small and new business concerns, and should report periodically on the extent of use of Government-owned inventions.

VI. Foreign Rights

Under every invention in which the Government acquires a free, nonexclusive license in the United States, it should also acquire a similar license operative in foreign countries.

Under every invention to which the Government acquires title in the United States, it should also acquire the right to control the ownership, use and disposition of the foreign patent rights therein.

If in respect of any invention acquired by the United States, the head of the agency and the Government Patents Administrator find that control over the foreign rights is not necessary or desirable in the public interest, such rights may be released to the employee or contractor involved, subject to any terms or conditions deemed proper in the public interest.

VII. Secrecy

Employees and contractors of the Government should be required to agree, in respect of any inventions made by them which the Government determines should be kept secret, that they will not disclose the invention to any unauthorized person, or assign any rights therein, or file any domestic or foreign patent applications, unless and until authorized to do so by the Government.

VIII. Uniform Policy and Procedure

A. FINDINGS AND CONCLUSIONS OF ATTORNEY GENERAL

1. President Roosevelt's letter inaugurating this Study noted the "need for a uniform Government-wide policy with respect to the ownership, use or control of inventions made by employees of the Federal Government, or by employees of Government contractors in the course of performing contracts financed by the United States," and this investigation has fully demonstrated the soundness of that observation. A uniform policy will extend to all Federal agencies the benefits of sound patent principles, will avoid competition among the agencies, and will strengthen the Government's bargaining position. Exceptions to the basic policy, where these prove desirable, should also be governed by uniform principles centrally administered, to avoid conflict and a possible breakdown of the policy itself.

2. The patent policy recommended above, since it has to do with employment and contracting within the executive branch, may be prescribed by executive order and implemented by departmental regulations. It does not affect the existing patent laws or the present patent system in any respect.

B. RECOMMENDATIONS OF ATTORNEY GENERAL

1. A Government Patents Administration should be established by the President, headed by a Government Patents Administrator to be appointed by the President, and assisted and advised by an Advisory Patents Board consisting of representatives of Government, industry, labor, education, and the consuming public. The Government representatives should consist of one person from each of the following Government agencies: Departments of Agriculture, Commerce, Interior, Justice, Navy and War; Federal Security Agency; Federal Works Agency; National Academy of Sciences; National Advisory Committee for Aeronautics; Office of Scientific Research and Development, or its successor; Reconstruction Finance Corporation; and Tennessee Valley Authority, designated by the head of the agency. The other representatives should be designated by the President.

2. The Government Patents Administrator, assisted by the Patents Advisory Board, should be charged with the functions of admin-

istering, interpreting, and enforcing the uniform patent policy to be established by the President, and determining and settling any controversies arising thereunder.

CHAPTER ONE—THE PATENT ASPECTS OF GOVERNMENT RESEARCH

Scientific and technological research conducted or financed by the United States represents a vast national resource, rivalling in actual and potential value the public domain opened to settlement in the last century. Because the control of patent rights in inventions resulting from such activities means the control of the fruits of this resource, it is important to determine upon a policy for the Government which will best serve the public interest, further the progress of science and the useful arts, and spread the benefits of the scientific advances as widely as possible.

I. Government Research

The activities of the United States Government in the field of scientific and technological research and development almost mirror our national history and economic progress. The earliest research undertaken by the Federal Government, shortly after the Revolutionary War, was in the field of military science, which continued to be emphasized during the early decades of our history. The emphasis gradually shifted to agrarian technology, and with the opening and development of our continent during the second half of the nineteenth century, the Government's scientic exploration expanded considerably to meet public needs in the domain of agriculture, public health and other fields. Until the beginning of the second World War, the major part of Government research and development was still devoted to agriculture and the development of land resources. The requirements of modern warfare then led scientific inquiry into such fields as aviation, ordnance, atomic energy, communications and shipping, which have accounted for more than three-fourths of the two billion dollars expended on Federal research during the five-year period 1940–1945. The war emergency also led to a great expansion in the technological equipment of the country, largely with Federal funds. To meet the unprecedented demands of World War II, existing Government research facilities were expanded, new plants and laboratories were constructed and equipped, and the full scientific resources of the country, including industrial and institutional as well as Government laboratories, were mobilized under Federal direction.[1]

The increase in Federal research expenditures during the past quarter century has been spectacular. From an annual research budget of about $20,000,000 in 1920 and $50,000,000 in 1938, the Government's expenditures for scientific research leaped to over $700,000,000 in 1944, exclusive of its activities in the field of atomic energy. The

[1] *Research—a National Resource* (U.S. National Resources Committee), Part I (Nov. 1938), pp. 72–74; Subcommittee Report No. 5, *The Government's Wartime Research and Development, 1940–44*, Report of Subcommittee on War Mobilization to the Senate Committee on Military Affairs, 79th Cong., 1st Sess., Part I (Jan. 23, 1945), pp. vii, 278–326; *id.*, Part II (July 1945), pp. 3–8.

For data on the growth of industrial research during this period, see *Industrial Research and Changing Technology* (W. P. A. Nat. Research Proj., Jan. 1940); *Research—a National Resource, supra*, Part II (Dec. 1940), pp. 19–39.

latter phase of wartime research added about $200,000,000 to the budget for pure research activities, and about 2 billion dollars if there is taken into account the cost of the pilot plants, manufacturing facilities and other equipment necessary for the production of the first atom bomb. Whereas before the war private industry financed about two-thirds of the Nation's research, with about one-sixth coming from Government and one-sixth from universities and research foundations, by the end of the fiscal year 1944 the Government was financing more than three-quarters of all research, the total annual expenditure of which was at least doubled. During 1944, a year representative of the war period, the research functions of the Government engaged some 36,000 civilian employees, of whom at least 20,000 were scientists and technicians. In that year about $500,000,000 in Federal funds (some 70% of the total research expenditures) was paid to outside organizations, most of it for research relating to aircraft, automotive transportation, communications and synthetic rubber.[2]

More than a dozen Federal departments and agencies regularly conduct or finance an appreciable amount of research and development work in science and technology as a part of their normal functions. The most important agencies in this respect are the Departments of War, Navy, Agriculture, Interior, and Commerce, and the National Advisory Committee for Aeronautics. During the recent war, temporary agencies such as the Office of Scientific Research and Development and the wartime subsidiaries of Reconstruction Finance Corporation also sponsored considerable research in significant fields.

The Nation's facilities for technological and scientific development (governmental, institutional and private), and the technical skill and learning available among our population, constitute one of our most valuable national resources.[3] Congress has in fact displayed a considerable interest in this giant force which possesses such tremendous potentialities to serve the public weal, and bills have been introduced which would give direction and stimulation to national research and supply generous grants of public funds to aid it. This legislation, exemplified by the Kilgore and Magnuson bills,[4] would establish a National Science Foundation to finance research at industrial, educational, nonprofit and governmental laboratories, by means of contracts, loans and grants. The hearings on these measures during October 1945 before the Subcommittee on War Mobilization of the Senate Committee on Military Affairs, at which leading scientists, business leaders, and Government officials endorsed the program, presage an important role by the Federal government in a greatly expanded postwar program of scientific research and development.

Indeed, the nature of our modern industrial economy, and the marked acceleration of scientific advance in many fields during World War II, would seem to make inevitable a substantial participation by the Government in postwar research. The dramatic developments in the fields of radar, jet propulsion, rocket missiles and the atomic bomb

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[2] *Research—a National Resource* (*supra*, note 1). Part I, pp. 73–74, 91; Report No. 5 (*supra*, note 1), Part II, pp. 3–5. S. The personnel figures are taken from the separate agency reports in Part I of Report No. 5.

[3] Bush, *Science, the Endless Frontier*, Report to the President on a Program for Postwar Scientific Research (July 1945), pp. 2, 19.

[4] S. 1297, S. 1285, and S. 1850, 79th Cong., 2d Sess. These bills and the Committee hearings and reports thereon, are fully discussed in the Monograph on Prior Studies, pp. 221–277. Similar measures have been introduced in the 80th Congress.

have brought forcibly to our attention the significance of science and technology in modern war; but most of these developments have great peacetime potentialities as well. The overwhelming need for medical research to aid in establishing a higher norm of physical well-being in our country was sharply emphasized by the disconcerting results of the physical tests made in connection with Army admissions. And the forces which modern science can muster to meet those needs are exemplified by the wartime development of such products as the sulfa drugs, penicillin and DDT.

One lesson repeats itself in this recital of scientific strides during World War II: that the greatest advancements in the field of science will be encouraged and expedited if active participation and financial aid are supplied by the Government. This is particularly true in the field of basic scientific research, which was relatively neglected during the war years when emphasis was necessarily placed upon applied research.[5] The technological problems posed by our present civilization are of such magnitude, and the need for their solution so urgent, that only by the pooling of resources and information on a nation-wide scale can the challenge adequately be met. The cost of the experiments are the developments; the knowledge, experience and information that must be accumulated and correlated; and the financial risks involved, are such that private industry, necessarily gauging its activities by the possibility of profit and the risk of loss, would in all likelihood be unable to carry the burden by itself. Consequently, the Government must perform or underwrite the research in whole or in part, if the advantages of a concentrated attack upon the most vital problems are to be had. Legislation such as the Kilgore bill recognizes this truism and proposes to accomplish the desired objectives by a partnership arrangement between Government and private organizations, whereby the Government furnishes the funds and collects and disseminates information, and the private organizations actually carry out the research.

Whether or not this proves to be the pattern of postwar research, Federal contribution and participation on a large scale seem certain. For the fiscal year ending June 30, 1947, about $700,000,000 was appropriated for scientific research and development by the several Government agencies, excluding research on atomic energy. To this should be added some $800,000,000 available on July 1, 1946 as unliquidated obligations from prior fiscal years, making a total of one and a half billion dollars, available for such research.[6]

Moreover, these activities will be carried on in the most modern manner and with the best available facilities. The Government's research program has called upon and will continue to utilize the great private and institutional laboratories to an ever increasing degree, and in common with these organizations, the Government's own research facilities involve, not the solitary inventor, but corps of professionals—engineers, physicists, chemists, mechanics—organized and centrally directed research teams engaged in cooperative attacks upon major problems.

[5] See *The Great Science Debate*, 33 Fortune, No. 6 (June 1946), p. 116. The Navy Department has already embarked upon a long range, basic research program.

[6] Tabulation of Funds Available for Research and Development for Fiscal Year 1947, prepared by the Bureau of the Budget (Oct. 24, 1946). Another summary of funds available indicates that atomic energy research will take $200,000,000. 92 Cong. Rec. (July 2, 1945), p. 8265 (Daily Edition). See also the recommendation of Dr. Vannevar Bush, in his recent report to the President, for a Government-supported research program which, by the end of five years, will involve the expenditure of over $120,000,000 annually. Bush (*supra*, note 3), p. 33.

II. Patent Problems Posed By Government-Financed Research

Scientific research is one of our great national resources; and advances in scientific and technological knowledge are its fruits. Since many of the discoveries and developments produced in the course of Government-financed research will be of a patentable nature, their use and enjoyment will depend upon the control of the patent rights.

Patent rights have a triple significance to the Government. (1) They have an "immunity value," as a means of reducing or eliminating the costs to the United States of making or using inventions in connection with Government production or procurement. This aspect of the patent may be its most valuable feature, if the invention is useful principally or entirely to the Government; but such a situation is becoming progressively rarer as science continues to multiply the potential uses of every important discovery. (2) Patents have a "pecuniary value," as an item of property which can be sold, licensed at a royalty, or used to acquire rights in other patents (for example, through cross-licensing). (3) Patents have an "exclusionary value"—the power to exclude others from the use of the invention or to permit use upon stipulated conditions. This power is of great significance.

The "exclusionary" aspect of the patent is the source of the so-called "commercial rights" in the patent, since it enables the owner to exploit the invention, or to suppress the invention in favor of existing processes and technology, behind the protective monopoly of the patent, or to exercise some control over the activities of others by licensing the invention upon conditions to the extent permitted by law. In the hands of the Government, the patent possesses a unique, if somewhat negative "exclusionary" significance, since it deprives private persons of any power to exclude or limit the use of the invention.

These attributes of a patent acquire added importance when they relate to technological improvements which have both wartime importance and valuable potentialities for peacetime use, such as atomic energy, radar, synthetic rubber, synthetic medicines, plastics, and jet propulsion.

This report is concerned primarily with the control, disposition and use of patent rights in inventions resulting from research conducted or financed by the Government, and with the formulation of a policy for such inventions that will best serve the public interest, further the progress of science and bring about the most widespread enjoyment of its benefits. The inquiry is pertinent to the several thousand patents and patent applications which the United States already owns or controls, mainly as a result of Government-financed research; and to the additional thousands under which it possesses a license.[7] But chiefly it concerns the inventions and discoveries that will be produced each year in the course of Federal research activities—functions which may be expected to continue on a scale surpassing all prior peacetime operations.

More particularly, this study has sought answers to the following problems relating to inventions made by a Government employee, a Government contractor, or some other recipient of Federal funds or

[7] The sources of the Government's patent rights are fivefold: (1) inventions made by Federal employees; (2) inventions made by contractors under Government contract for research and development; (3) inventions made by lessees or operating agents of Government-owned plants and facilities; (4) patents and licenses purchased by or voluntarily assigned to the United States; and (5) patents and licenses seized by the Alien Property Custodian.

facilities, and to patent rights otherwise acquired by the United States:

1. Who should own or control the invention: The employee, the contractor, the grantee, the Government?

2. What rights, if any, should the others have therein? Should foreign patent rights be treated differently than domestic patent rights?

3. If the employee, the contractor or the grantee is given ownership, what controls or conditions, if any, should be imposed by the Government as to the use of the invention?

4. If the Government is given ownership, should the invention be dedicated to the public, and if so, should it first be patented?

5. If the invention is patented by the Government and is to be licensed, what provisions should be made in respect of (*a*) exclusiveness of nonexclusiveness; (*b*) royalties; (*c*) the manufacture, use or sale of the invention, or the making of further patentable improvements therein by the licensee?

6. Should Government-owned patents be sold, and if so, under what terms and conditions, if any?

7. A part from any rights in his invention, should the Government employee be given a special reward on account of the invention, such as a cash bonus, participation in the commercial proceeds, if any, salary increase, promotion, public recognition?

8. What procedures, if any, should be adopted to apprise science, industry, and the general public of the results of Government-sponsored research; to notify the public and the several Governmental agencies of technological advances and discoveries available for use under license or otherwise; and to finance or otherwise aid in the solution of experimental or developmental work necessary for commercial exploitation of the invention?

9. To what extent should a uniform policy be adopted for the entire Government?

10. If a uniform policy is adopted, how shall it be administered, and what provision, if any, should be made for exceptions?

III. Objectives of a Sound Policy

There can be little disagreement as to the principal aims of a sound policy relating to inventions in which the Federal Government has an interest. The best policy would satisfy the following four criteria:

1. The policy should serve the public welfare, which can be postulated to involve the most widespread use of the invention in the interests of the health, safety and prosperity of the Nation.

2. The policy should not discourage the making of new inventions, but on the contrary should stimulate the progress of science and the useful arts.

3. The policy should be consistent with our American system of free competitive enterprise.

4. The policy should meet the full needs of the Government, both in normal times and in periods of emergency, and should not interfere with the functions or objectives of the individual Government agencies.

To the extent that all of these criteria cannot be met simultaneously, it must be decided which factor or factors should be subordinated, and in what circumstances.

GOVERNMENT PATENT POLICY ITS IMPACT ON CONTRACTOR COOPERATION WITH THE GOVERNMENT AND WIDESPREAD USE OF GOVERNMENT SPONSORED TECHNOLOGY

1963

This study was done by the Subcommittee on Research and Development of the National Defense Committee of the Chamber of Commerce of the United States.* The report was prepared at the initiative of the Chamber, and it was submitted to the Secretary of Defense, then Mr. Robert S. McNamara, in December 1963.

* IDEA, Patent, Trademark, and Copyright Journal of Research and Education, v. 9 (Spring-Summer 1965), pp. 109–273.

GOVERNMENT PATENT POLICY ITS IMPACT ON CONTRACTOR COOPERATION WITH THE GOVERNMENT AND WIDESPREAD USE OF GOVERNMENT SPONSORED TECHNOLOGY [1]

(By Helge Holst [2])

1963

Summary and Conclusion

A study has been made—as factual as possible in a sensitive area—of the impact of Government patent policy on the availability and cooperation of organizations with the Government. Effort has likewise been devoted to learning the effect of applicable Government policies on the use of private, proprietary technology in work for the Government, and reciprocally on the likelihood of wider use of technology developed on work for the Government in civilan applications of benefit to the nation.

The data obtained is striking. It represents responses of contractors, large, small and intermediate, who provide over $10 billion of procurement to the Government each year. Their percentages of work for the Government to total sales, range from very small to 100 percent. It likewise reveals the attitudes of some organizations who do not serve the Government but are the kind which could contribute helpfully if they did undertake Government work. These firms constitute 2,268,000 employees and supporting plant and equipment. They therefore comprise a significant resource of the nation.

In summary, the responses to the questionnaire indicate that organizations of the type which serve the Department of Defense, the Space Agency, the Atomic Energy Commission and other agencies of the Government which require technical items and services involving considerable technology, do hold and do depend for their commercial position upon patent rights and proprietary data. Such organizations for the most part serve the Government in their fields of specialization. In general, it is not the policy of such organizations to license others to compete with themselves, but they are, nevertheless, in general, prepared to deal with the Government in ways which permit use of second sources.

Government patent policy is a significant factor in discouraging responsible, competent organizations with substantial backgrounds of experience and proprietary rights from bidding on work for the Gov-

[1] Condensed from a report presented to Secretary of Defense, Robert S. McNamara, on December 11, 1963. This report was prepared by the Subcommittee on Research and Development of the National Defense Committee of the Chamber of Commerce of the United States.

[2] Mr. Holst was Chairman of the Subcommittee referred to in the previous footnote. He is Corporate Counsel of Arthur D. Little, Inc., in Cambridge, Massachusetts.

ernment. It is a fact that many such organizations do actually refrain from bidding on work for Government agencies whose patent policies they disapprove. This finding should not be overlooked despite the apparent ability of the Government to secure contractors. Indeed, it is to be questioned what background available contractors do bring to their Government work.

Where organizations which disapprove of the patent policy of a Government agency do nevertheless undertake to work for the Government, they quite generally isolate their Government operations as a means to protecting proprietary rights, as well as for other purposes. There are indications that such isolation restricts the input of the organization's technology into work for the Government and likewise impedes flow of new findings from Government work back into the operation of the organization and thus into the general economy. This segregation, and the general attitude of organizations toward work for the Government, results from a fear that the terms sought by the Government threatened the commercial position of contractors to the Government.

There is significant evidence that organizations which undertake work for the Government are able to utilize know-how or other findings for other purposes. It is abundantly evident, however, that in applying such developments for other purposes, very substantial additional effort and cost is required—in relatively few instances can a direct transfer of the same product or service be made from Government purposes to civilian application.

There is, unfortunately, evidence that the devotion of private research and development to Government work has produced a slowdown in the development of products for the general economy. It is also clear that many managements are reluctant to devote to Government work the high calibre personnel required to solve difficult problems because the withdrawal of such superior personnel from their regular operations would delay development of commercial products or expose the organization's regular business to the risk of falling behind the developments of their competitors. There is also evidence that such work for the Government has tended to incresae the cost of private research and development.

Despite fears of Government work, and its consequences to the remainder of their operations, and despite the recognition of the relatively poor financial return from work for the Government, organizations are frequently motivated to undertake such activities in the hope of acquiring know-how and patent rights.

In any consideration of this subject, it has seemed particularly necessary not to become lost in the relative equities of the Government and the contractor. Accordingly, this study makes a special effort to focus on the best interests of the nation. This has been done by concentrating on the two major considerations:

(1) What policy will best enable the Government to secure the most helpful assistance on primary governmental problems?

(2) How can such work be carried out in ways which will produce maximum useful benefit to the economy at large?

As has been stated by representatives of the Government itself, in seeking the assistance of outside organizations, the Government desires better weapons, space systems, components, or other services directly needed for carrying out governmental functions. The patent

policies and technical data provisions under which the Government deals with its contractors must, therefore, above all else seek to obtain that objective—first things first—the best possible end items and serivces at reasonable cost. To do so, governmental policies must attract the most capable organizations in the relevant fields of interest. In enlisting such organizations, it must have their whole-hearted and enthusiastic support. As participants they must be willing to devote their best talents, pertinent background, existing technology (whether proprietary or not), facilities, and all other resources to the work of the Government. There must be no holding back in any regard—no isolation of personnel, facilities, technology or skill which shut off any ability of any type which could contribute helpfully to the direct and vital interests of the Government.

The present study clearly shows that under its present policies as they are understood by contractors, the Government is not securing ready access to all organizations, especially those with pertinent proprietary rights. Moreover, even where such contractors do undertake work for the Government, they do so with a belief that Government patent (and data) policies are inimical to or threaten their basic interests. Despite this attitude, contractors in general remain remarkably willing to give the Government such rights as are truly needed to permit competitive procurement from multiple sources. It is believed, however, that if the Government would recognize the economic worth of the rights required to be surrendered by contractors for this purpose, and would deal with them on an economic and more nearly commercial basis, the cooperation of industrial organizations would be more widely available.

Now that the role of research and development in the creation of new products, new processes, new work opportunities, new tax revenues and general benefits to the public is being more clearly recognized, it is apparent that the widest possible public benefits should be secured from all work undertaken for the Government. It is therefore increasingly necessary to recognize the fundamental requirements of the economic system prerequisite to the utilization of new technology. In securing wider secondary applications, clearly, the difficulties of communication to the private sector will be reduced if the initial work is performed in the private sector. But beyond the problems of communication lie the need for incentives to take the steps needed to achieve further use. These requirements are many and varied. Individual experience and the public statistics indicate the magnitude of hazard and cost involved in launching new products and services. Speculative investment of this type should therefore not be undertaken by public agencies with public funds. It is believed best that such risks be borne by those who may reap the rewards of success but will also experience the losses of failures. This will lead them to operate under the pressures and restraints of investing their own funds and consequently provide maximum motivation to make such ventures succeed.

All factors considered in this complex area, it is believed to be in the Government's best interest to employ patent and data policies which have as their primary objective the assuring of Government access to the most able organizations for direct work on Government problems. The secondary objective of securing widespread use of resulting technology will then be best advanced by providing conditions which

afford maximum incentive to organizations to make application of any useful results of their work for the Government. It is considered that both primary and secondary objectives will best be achieved by leaving ownership of inventions and technology with those who originate them. This will provide incentive to capable organizations to serve the Government. It will likewise motivate the further very substantial efforts required to make further use of the developments. Such expanded use will benefit the Government, directly and indirectly.

Even though developments may be initiated under Government sponsorship, in almost every case their utilization cannot be achieved without further large and complex effort and cost on the part of the originators or developers. Thus, any benefits obtained would seldom constitute "windfall" enrichment. To the extent that such benefit is an added reward, it is inducement and compensation to organizations to perform work for the Government. In any event since benefits to the private developer cannot be obtained without conferring a wide circle of benefits to the public, employees, and the Government itself, a policy which achieves these results does accomplish the secondary objective of Government policy regarding patents and technology developed under Government sponsorship.

It is urged that the full data and discussion herein be carefully studied by those responsible for development of Government patent policy, including those charged with implementation of the Presidential Patent Memorandum of October 10, 1963. It is believed that patent policies and their implementation should be developed along lines which recognize the realities and vitality of the private enterprise system, including (a) the advantages to the Government of access to experienced organizations whose background and standards of quality would be useful, and (b) the prerequisites for promotion of new developments.

Presidential Memorandum on Government Patent Policy

On October 10, 1963, President Kennedy issued a memorandum to heads of Executive Departments and Agencies on Government patent policy. This Memorandum gives added urgency to realistic appraisal of the factors with which this report is concerned. The Memorandum outlines policy guidelines with respect to ownership of inventions growing out of work sponsored by Government contract. The statement growing out of work sponsored by Government contract. The statement is largely silent on the importance of securing the cooperation of the most relevant organizations to serve as contractors, but clearly emphasizes the objective of greater utilization of beneficial results growing out of Government-sponsored work. Moreover, the Memorandum specifically provides that a patent advisory panel be established under the Federal Council for Science and Technology to develop recommendations and to prescribe procedures for implementation of the policy.

Basic consideration for the development of patent policy is stated to be the fact that inventions in scientific and technological fields resulting from work performed under Government contracts constitutes a valuable national resource. The Memorandum likewise indicates that use and practice of their inventions and discoveries should stimulate inventors, meet the needs of the Government; recognize the equities

of the contractor, and serve the public interest. It asserts that public interest in a dynamic and efficient economy requires that efforts be made to encourage the expeditious development and civilian use of these inventions. The Memorandum then acknowledges: "Both the need for incentives to draw forth initiatives to this end, and the need to promote healthy competition in industry, must be weighed in the disposition of patent rights under Government contracts. Where exclusive rights are acquired by the contractor, he remains subject to the provisions of the anti-trust laws."

The above summary clearly recognizes some of the basic considerations which should control in the development of sound governmental patent policy. It is necessary to realize, however, that assembly of relevant considerations is not in itself achievement of sound patent policy. Policy is sound only if it achieves the results desired. In general, the *objectives sought* by the Presidential Memorandum are the same as those considered herein to be of paramount importance. However, the Presidential guidelines than proceed to outline a variety of conditions under which ownership of inventions will be taken by the Government. It likewise prescribed circumstances under which inventions acquired by the Government may be dedicated to the public or licensed on a non-exclusive basis. The experience of private enterprise strongly suggests that without private ownership, and in the absence of the right to exploit new developments on an exclusive or more-or-less exclusive basis, there will seldom be the additional investment and effort required to bring about actual widespread use. It is, therefore, questioned whether "dedication" of inventions to the public, or widespread adoption of the policy of non-exclusive licensing will in fact achieve widespread use. Moreover, the Presidential Memorandum fails to give recognition to the need for attracting desirable organizations to serve the Government, an objective of even greater significance than secondary use.

It is in the Government's interest to enlist the most competent contractors with the most pertinent background, and this is likewise best for the nation. It would seem that the importance of such participation by the country's resources of talent and productive skill becomes even greater in matters of national defense and survival. Every reasonable effort and policy should therefore be directed to achieving the primary objective of government contracting—the effective and speedy solution of primary governmental problems, and swift implementation of such solutions into functional systems. To likelihood of success in meeting primary objectives, can then be added the second but clearly subordinate objective of achieving widespread utilization of possible secondary benefits. Other considerations and objectives should come only after full recognition of the first two and should be subservient to them.

The Presidential Memorandum throws light on this subject, but makes all the more important the proper understanding of fundamentals. Moreover, the Memorandum itself requires periodic evaluation of the actual results of Government patent policy. Accordingly, this report, which was initiated prior to the issuance of the President's Memorandum, deals with what are regarded as basic considerations for evolution of sound Government patent policy.

Government Patent Policy and Its Impact on Contractor Cooperation With the Government and Widespread Use of Government Sponsored Technology

INTRODUCTION

Government patent policy vitally concerns Congress, the Executive Departments and contractors. Legislative bills on the subject filed in Congress this year include H.R. 471 (Daddario Bill), S. 1290 (McClellan), S. 1432 (Long), and S. 1623 (Saltonstall). Public and private discussions of the topic are legion. Time consuming and costly studies and investigations of related matters have been conducted for several years. These have been far reaching and involved notable contributors. Included among the major efforts have been the investigations of the Subcommittee on Patents and Scientific Inventions under Congressman Erwin Mitchell, Chairman (House Report 1633, May 19, 1960), the same Subcommittee on Patents and Scientific Inventions under Congressman Emilio Daddario, Chairman (House Report 2185 of August 14, 1962), the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary under Senator McClellan (Hearings, April–May, 1961).

Although these subjects have been studied with care, and the queries and responses have been based upon the experience of those concerned, to date little statistical evidence has been presented as to:

(a) The availability or non-availability of contractors to the Government as affected by Government patent policy;

(b) The effect of Government patent policy on the flow of technology to and from work for the Government and into general public benefit; and

(c) The importance of patents and proprietary rights to the use of such technology by private organizations.

The present study is a conscious effort to gather and to interpret factual and statistical data in this area rather than merely to express opinions for or against certain policies. It is an attempt to evaluate the impact of Government patent policy on the Government's own interests. While the welfare of contractors is an important consideration, it is here treated as subordinate to the interest of the Nation. Nevertheless, it is essential to recognize the basic economic factors motivating the conduct of contractors, which materially influence their willingness to undertake work for the Government, and their effectiveness in implementing widespread use of new developments. This subject and its ramifications are too important, too intricate, and too difficult of comprehension to be answer with such slogans as "What the Government pays for it should get." Nor is it sufficient to assert that since employers demand the transfer to them of inventions made by employees, it is consistent and equally useful for the Government to demand transfer to it of inventions made by contractors. The role and the needs of a private economic entity and of the Government are not identical.

NATURE OF THIS STUDY

In an effort to obtain factual basis for this study, a questionnaire was prepared for widespread distribution. However, it was then advised that the questions dealt with subject matter of such sensitivity that general broadcast of the questionnaire would not result in candid

replies. As a consequence, the questions were revised and distributed to organizations known to be contractors to the Government, or to be the types of organizations whose competence was such that their services would be of use to various Government agencies. Personal contact was made with these organizations in forwarding the questionnaire and an explanatory memorandum urged accuracy and frankness in response. It was emphasized that the information was sought in order to provide factual answers from which reliable guidance could be developed for all parties concerned—the Executive Departments of Government, Congress, and contractors. After receipt and analysis of the responses, which frequently included supplementary memoranda and letters, follow-up interviews were held to obtain more complete data on the subjects of the questionnaire and related aspects of the investigation.

[The questionnaire used and—in summary—the responses obtained were as follows:

GOVERNMENT PATENT POLICY QUESTIONNAIRE

(a) Size of company; number of employees: varied form 80 to 145,000.
(b) Sales to Government: from zero to $2,600,000,000.
(c) Percentage of Government sales to total sales: from zero to 100 percent.

1. Do you hold or depend on patent rights for your commercial position in one or more of your fields of operation? "Yes" 92%; "No" 7%; "Other" 1%.

2. Do you work for the Government in one or more of your fields of specialization? "Yes" 77%; "No" 23%.

3. Is it your policy to license others under your patents in your fields of operation? "Yes" 72%; "No" 9%; "Other" 19%.

4. Are you willing to license or to give the Government background patent rights?

(a) for Government Purposes: "yes" 76%; "No" 19%; "Other" 5%.
(b) for commercial purposes? "Yes" 16%; "No" 19%; "Other" 2%.

5. Has its patent policy been a factor in discouraging you from bidding on work for any Government agecny? "Yes" 80%; "No" 18%; "Other" 2%.

6. Have you actually refrained from bidding on Government work for any agency because of its patent policies? "Yes" 56%; "No" 36%; "Other" 8%.

7. Does the policy of certain Government agencies in taking title to patents resulting from Government-sponsored R&D lead you to keep Government work segregated, or confined to certain divisions? "Yes" 48%; "No" 29%; "Other "23%.

8. Has your work for, or terms sought by, the Government appeared to threaten or affect your commerical position? "Yes" 51%; "No" 22%; "Other" 27%.

9. Can you cite the utilization in commercial products of any know-how or patented rights developed or growing out of work for the Government? "Yes" 30%; "No" 46%; "Other" 24%.

10. Can you indicate how much additional effort or expense was required to adapt or further develop the concept or know-how derived from the Government work to a generally useful product or service?

Where there has been experience, the added cost has been substantial.

11. Has the devotion of your research and development or other talent and facilities to Government work slowed down or otherwise affected your production of commercial products "Yes" 30%; "No" 43%; "Other" 27%?

(a) Has it affected your cost of operation? "Yes" 30%; "No" 48%; "Other" 22%.

12. Does the opportunity to develop know-how or patent rights provide incentive to you to undertake work for the Government?

(a) know-how "Yes" 83%; "No" 13%; "Other" 4%.
(b) patent rights "Yes" 63%; "No" 28%; "Other" 9%.

Size of Respondents, Volume of Government Contracting Represented, and Percentage of Government Work.

In soliciting responses, a careful effort was made to avoid predetermining the replies which would be obtained. Instead, an effort was made to cover representative organizations, both small and large. Some of those invited perform only small proportions of their work for the Government while others were almost wholly dependent upon Government sales. In fact, responses were obtained from small, intermediate, and large entities. The respondent with the smallest number of em-

ployees operates with a staff of 80; the largest with 140,000. Similarly the proportion of Government work performed ran from zero to 100%. The total number of employees in these organizations is more than 2,268,000 and the total procurement provided by these organizations in 1962 was well above $10 billion. It is believed, therefore, that the organization by size, proportion of sales to the Government, and quantity of procurement, properly sample the attitudes of organizations dealing with the Government.

Because of the personal relationships used in soliciting these responses, and the knowledge of the organizations by the interrogators, it is believed that the responses given reflect an unusual degree of candor in disclosing matters not normally made public. Moreover, the questions were designed to contain elements of self-verification. For example, Question #5 inquired: "Has the Government's patent policy been a factor in discouraging you from bidding on work for any Government agency?" and might well have resulted in a nearly unanimous "yes" response—the significant factor being to reflect discouragement or dislike of the patent policy. In contrast, Question #6 asked: "Have you actually refrained from bidding on Government work for any agency because of its patent policies?" It was expected that responses would not be anywhere nearly as affirmative. Evidence of frankness in answers, together with the more extended comments and disclosures obtained, commend these findings for serious consideration.

Result of Survey

Question No. 1. The significance of Patents to Commercial Organizations.

At the outset, it was thought desirable to learn what importance private organizations attach to their patents. This answer was sought to supply insight into the utility of patents and related data to the organizations interrogated and, therefore, provide a basis for evaluation of reactions to Government patent policy.

Question No. 1 accordingly asked: "Do you hold or depend on patent rights for your commercial position in one or more of your fields of operation?" The answers were: "Yes" 92%; "No" 7%; "Other" 1%.

Clearly, this shows a high degree of reliance upon patents for economic position. The degree of affirmative response came as a surprise since it is generally recognized that patents alone, without a high degree of competence in production, sales and administration, will not assure success. The dependence on patent rights, shown by this vastly preponderant reply, explains to a considerable degree the strong desire of private organizations to protect the results of their research and development and to convert them into proprietary assets of the organizations. This conclusion is reinforced by the response to Question #12.

Question No. 2. Contractors' Fields to Work for the Government.

Since it is recognized that contractors can make a particularly helpful contribution to the Government if, in fact, they work for it in fields in which they have substantial background, the second question of the survey was aimed at determining whether or not contractors do in fact serve the Government in their fields of specialization. This inquiry seemed particularly desirable to determine the possibility of enlisting contractor background competence, and also because the more relevant such background, the more realistic would seem to be the fear expressed by many organizations that work for the Government jeopardizes their proprietary position.

Question No. 2 of the survey, therefore, inquired: "Do you work for the Government in one or more of your fields of specialization?" The answers were 77% "Yes"; 23% "No." This response should not be misunderstood. It does not say all affirmative respondents will undertake Government-sponsored R&D. It merely replies as to the nature of work performed for the Government. Nevertheless, this reply, for all of the reasons stated before, is clearly of interest to the Government. But it inevitably raises the question whether in undertaking work for the Government in their fields of commercial interest, contractors do, in fact, endanger their commercial status. If so, it is only natural for them to be reluctant to part with information which they feel threatens their proprietary position. In view of the replies to Question No. 8 discussed below, it is not surprising that there is great reluctance on the part of contractors to surrender foreground rights just as they are reluctant to convey away background inventions on which they depend for their economic position.

To retain perspective on this situation, it is well to emphasize the importance of "first things first." What is that it the Government sought from the contract which gave rise to the invention? If it is, in fact, the solution to difficult problems, the enlistment of the most competnet contractors and the application of their existing background for this purpose, Governmental policies should clearly be such as to encourage rather than repel participation and cooperation by organizations of this

type. Government ownership of patent rights is quire secondary to this priamry issue. The objective of Government policy should be, above all else, to attract and enlist competent organizations to serve the Government. That such organizations will seek to retain developments related to their fields of operation is natural. The opportunity to do so can serve as means of attracting such organizations to serve the Government. The need for wisdom in this decision is particularly emphasized in view of the fact that such organizations working in their regular areas of operation provide the greatest likelihood of the application of useful data and technology resulting from the Government-sponsored work for public benefit as described below under Question No. 9 and in Sections V and VIII.

Questions No. 3 and No. 4. Willingness of Contractors to License Others.

Questions No. 3 and No. 4 were intended to determine whether, despite the fact that patents comprise an essential means by which contractors maintain their commercial position, they are, nevertheless, willing, under appropriate circumstances, to license others in their fields of operation.

Question No. 3, therefore, asked: "Is it your policy to license others under your patents in your fields of operation?" The answer: "Yes" 72%; "No" 9%; "Other" 19%, was surprising. It was anticipated that organziations dependent for their commercial position upon patents would not be willing to license others under those patents since to do so might well comprise the creation of competition which would threaten the organization's position. It is possible that this acquiescence to licensing has come about through the sustained practice of the Government in insisting upon the right to create second sources.

It may be added that the fuller responses to this question provided by many organizations clearly indicate that when commercial organizations are prepared to license or otherwise negotiate for the use of their patents; in doing so they expect to operate on a commercial or economic basis and receive value for value given. With respect to patents and technical data, the normal basis for exchange is a royalty or other compensation. Transfers of rights usually also involve affirmative assistance in transmitting know-how, drawings and related data. This is the normal method of operation. It would seem a reasonable basis for operation between commercial organizations and should provide an acceptable method for securing the assistance and support of capable, private economic entities.

Question No. 4 inquired: "Are you willing to license or to give the Government background patent rights? (a) for governmental purposes? (b) for commercial purposes?"

The answers to this question amplify, but confirm the conclusions from the preceding question. The responses were:

(a) For Government purposes—"Yes" 76%; "No" 19%; "Other" 5%

(b) For commercial purposes—"Yes" 16%; "No" 82%; "Other" 2%

In other words, organizations are willing to license the Government for governmental purposes. They are quite unwilling to license the Government for commercial purposes. Hence, almost universal objection to the taking of title to inventions by the Government.

Questions No. 5 and No. 6. Effect of Government Patent Policy on Willingness of Contractors to Work for the Government

It is considered vital to the Government's primary interests to be able to enlist contractors with relevant work experience for the Government in areas of difficulty and uncertainty. It is known that many organizations disapprove of Government patent and data policies. It was accordingly thought desirable to learn (a) the extent of such disapproval; and (b) whether disapproval went so far as to result in organizations actually refusing to work for agencies of the Government with whose policies they disagreed. Frankly, it was expected that dislike of Government patent policies would be universal, but that actual refusal to enter into contracts would be rare.

Question No. 5 inquired: "Has its patent policy been a factor in discouraging you from bidding on work for any Government agency?"

The answers were: "Yes" 80%; "No" 18%; "Other" 2%.

Question No. 6 asked: "Have you actually refrained from bidding on Government work for any agency because of its patent policies?"

Answers: "Yes" 56%; "No" 36%; "Other" 8%.

Many, but not all, organizations dislike Government patent policy (and, it may be added, based on interviews, Government data policy). At least a portion of the acquiescence in the policy comes from organizations created expressly—and usually exclusively—to serve the Government. Contrary to expectation, this dislike to the patent policy is carried into positive refusal to work for agencies whose policies are

disapproved. This reply—56% actually not taking work—came as a surprise. It refutes the easy assumption by those who maintain that no matter what the policy, bidders will take Government contracts.

Under these circumstances, it would seem that objectionable policies eliminate more than half of potential desirable contractors. This is of enormous significance to the Government, both from the aspect of cost of work and even more with respect to the competence and efficiency with which it will be performed. If we assume that early and effective implementation of defense capability, at reasonable cost, is the prime objective of defense contracts, especially those involving difficult R&D, the answers given to Question No. 6 (and also Question No. 7 to be discussed) are cause for concern. They are sufficient cause for alarm so that they should lead responsible Government personnel to ask whether policies which produce their result should not be revised. How can it possibly be in the interest of the Nation to have its defense, space and other programs refused by competent organizations, or if undertaken, handled with obvious reluctance and isolation from the best know-how and talents of the organizations?

Question No. 7. Integration or Isolation of Government Work Within Contractor Organizations.

Because it is known that some organizations, which disapprove of the patent policies of certain agencies, nevertheless do undertake work for them, Question No. 7 sought to explore how such organizations reconciled themselves to the objectionable policies or performed work for the Government in ways which would not be injurious to them.

Question No. 7 therefore asked: "Does the policy of certain Government agencies, in taking title to patents resulting from Government-sponsored R&D, lead you to keep Government work segregated, or confined to certain divisions?"

The answers were: "Yes" 48%; "No" 29%; "Other" 23%.

A further objective of this question was directed to determine whether the way in which contractors administer work for the Government within their organizations contributes to or is likely to impede the flow of technology from (a) the contractor to the Government work and (b) from Government work back into the general operations of the contractor. It was thought significant to inquire into these aspects both to provide a check on the accuracy of the answers given to the preceding question, and also because of the direct relevance of the manner of operation to the likelihood of widespread utilization of findings made in work for the Government.

As might be expected, whether or not work for the Government is segregated, receives different consideration and varying treatment within different organizations. Particularly in the case of contractors which are essentially purely Government service organizations, the motives for segregation are not nearly as strong as in organizations which are basically commercial in orientation. Where the organization is created to serve the Government, isolation is seldom practiced. Likewise, other considerations, such as the degree of classification, or volume of work, will influence whether or not work for the Government is carried out as part of the organization's general operations or is treated as a separate and segregated operation.

From discussion with various organizations, it is evident that isolation of Government work is practiced for a variety of reasons. These range from the protection of proprietary rights to an endeavor to segregate costs associated with work for the Government. For whatever reason, the fact that 48% of contractors practice segregation of Government work because of Government patent policy and only 30%, or roughly one-third do not practice such isolation, is of considerable significance. Where there is segregation of Government work, it is clear that such work does not readily receive the benefits of know-how and skill in the contractor organization. Nor can Government work performed in isolation readily feed back contributions into the general operations of the contractor, unless a positive effort is made to transmit technology derived from Government work into the remainder of the organization—as by rotating personnel, arranging liaison with other members of the organization, or further and more or less unusual and additional steps than mere continuance of the regular operations of the organization. In other words, where there is isolation of Government work, there will not, in fact, be effective transfer of technology to and from Government work and the organization's regular operations. This is contrary to everyone's interest—the Government, the contractor and the public.

Impediments to the flow of technology into the regular operations of contractors is particularly regrettable. It would appear that in the usual case it is the organization which makes discoveries or developments in the course of Government work which is in the best position to utilize such technology. As noted before, the new

developments are likely to be in the field of the organization's regular operations. For this reason and because the development took place within the same organization, problems of communication should be at a minimum. It would therefore seem particularly undesirable that Government policies would reduce the likelihood of utilization by isolating Government work from the remainder of the organi zation. In contrast, if personnel are the same, whether the work be for the Government or for commercial purposes, there is no real problem of transfer of technology. Similarly, if personnel are rotated from Government work to the remainder of the organization, know-how requires change of organization, or further steps at transfer than would be required if there is close integration of work for the Government with all other operations of the organizations, clearly, isolation should be minimized where at all possible.

It is believed that a proper policy on the part of the Government, coupled with efforts to explain the virtues of integrated operation, would be a significant contribution to the transfer of technology and the widespread utilization of new knowledge developed in work for the Government. Moreover, it must be recognized that isolation or segregation is harmful in both directions—it impedes flow of the contractor's technology to the work for the Government as well as from it to the other operations of the organization. Therefore, appropriate steps to reduce isolation of Government work are clearly necessary in the interest of the Government for achieving both primary and secondary objectives.

Question No. 8. Government Work Considered a Threat to Commercial Position.

Question No. 8 was intended to explore reasons which make many organizations reluctant to undertake work for the Government.

Question No. 8 asked: "Has your work for, or the terms sought by the Government, appeared to threaten or affect your commercial position?"

Answers: "Yes" 51%; "No" 22%; "Other" 27%.

The responses received were a surprise. It was not thought that such a preponderantly large percentage, 50% to 70% (the higher figure is observed when "other" is interpreted) of respondents would consider that their service to the Government was a threat to their commercial position. Under these conditions, it is not surprising that many organizations entirely refuse to undertake work for the Government, especially work of a research and development nature in which proprietary rights become endangered. The significance of this attitude on the part of contractors should not be overlooked by the Government. It is hardly to be expected that contractors will devote themselves enthusiatically to assignments they consider to threaten their commercial position. It is relatively immaterial whether Government policies do, in fact, threaten the organizations. The ill effects will follow from the mere belief that Government terms are adverse to the organization.

It is believed that this general subject and the extent of unwillingness of contractors to undertake work for the Government is not understood in many quarters of the Government. For example, some officials frequently take comfort from the fact that they are able to secure respondents to their invitations for bid. But is this really sufficient? The question with which those responsible for good work should be concerned is—"Are we enlisting the most capable organizations, most likely to succeed in solving our problems, and to do so with minimum loss of time and at reasonable cost?" It is far from sufficient that some organizations of unproven skill will respond because they seek to enter fields new to them. Or that those organizations which do respond, arrange to operate in ways which do not enlist their best talent or secure access to their best know-how. Data in this area is difficult to obtain. It is not believed that anyone, including the Government agencies themselves, are aware of the extent to which capable organizations are withholding cooperation or do not undertake to participate in work for the Government. Moreover, it is believed that appearances may be deceptive in that organizations will only undertake subsequent stages of effort for the Government, or will do so only at fixed-price terms which do not include obligations to transmit technology, but will refuse to do so on the conditions normal to research and development. It is believed that this is an area well worthy of further study and careful evaluation.

Question No. 9. Utilization of Government-Sponsored Technology.

Question No. 9 was directed to explore the utilization in commercial products of any developments growing out of work sponsored by the Government. Accordingly, Question #9 inquired: "Can you cite the utilization in commercial products of any know-how or patented rights developed or growing out of work for the Government?"

Responses are interesting and revealing—"Yes" 30%; "No" 46%; "Other" 24%. This should be reassuring to Government administrators interested in the transfer of technology. The fact that 30% and a substantial proportion of the "Others," or at least one-third of the organizations had esperienced transfer, is likewise evidence that contractor organizations, under appropriate circumstances, are in a position to make use of technology developed in the course of their programs for the Government and to pursue this effort more actively under proper circumstances.

Indeed, in view of the greatly simplified problems of transfer of information, it is believed that the contractors who develop the new data (which responds to Question #2 indicate will usually be in the fields of normal operation of the organizations) will probably be the most frequent if not actually the best organizations to make wider use of the new developments.

Question No. 10. Added Effort and Cost of Adapting Developments from Government Work to General Use.

Since it was realized that relatively seldom would it be possible to offer the commercial market the identical product developed in the course of service to the Government, it was considered desirable to explore the extent of further effort and cost involved in making such transfers for general use. It was realized, of course, that efforts to trace specific items, while they would provide specific answers, would have to be evaluated with care since the exact difficulties or costs of transfer with respect to one invention might be quite different from those involved in applying others.

As might be expected, the answers indicate a wide range of additional effort and costs. In almost every case, it is evident that the cost of further development and utilization greatly exceeds the initial cost of conception or invention. The extent to which costs subsequent to the inventive act are required is illustrated in a number of instances. These costs frequently run from 50 to 100 times the cost of initial development. Examples of such developments are cited in the notes.

It is of interest to note that the expanded comments obtained clearly reveal that the benefits from undertaking Government work are usually of a generalized character. Ordinarily they comprise technology or skill which can be given other applications, rather than the immediate transfer of identical items or services from military to civilian purposes. This is not surprising since it would hardly be expected that there would be exact counterparts to weapons, space vehicles and the like. It is evident that "transfer" or "fall-out" is not easy or automatic, but will require ingenuity, perseverance, and almost certainly substantial cost. Moreover, as military, space and other Government requirements become more specialized, not only will the opportunity for direct fall-out be reduced, but the necessity for and cost of adaptation will be increased.

Question No. 11. Impact of Work for the Government on Other Work of the Contractor.

Question No. 11 was intended to learn the extent to which work for the Government displaces or impedes the regular work of the organization. This was considered important in the light of the general belief that the use of scarce talent on Government assignments has now risen to such a level that it undermines and postpones the prosecution of work of more general application to the public.

Question No. 11 therefore inquired: "Has the devotion of your research and development or other talent and facilities to Government work slowed down or otherwise affected your production of commercial products? Has it affected your cost of operation?"

Answers:

(a) "Yes" 30%; "No" 43%; "Other" 27%.
(b) "Yes" 30%; "No" 48%; "Other" 22%.

It would seem to be of serious consequence that the number of organizations which consider that their work for the Government has not adversely affected their other activities is a relatively small minority. In contrast, a substantial proportion of respondents consider that their general activities have been adversely affected. The replies, which are neither "yes" or "no", discuss in more detail the impact of Government work on their general activities. The "no" answers likewise reflect the experience of organizations which perform no work for the Government or sell only regular commercial products to the Government. Since a number of organizations have been created expressly to serve the Government, it is not surprising that some of these organizations can declare with accuracy that their Govenrment work has not imposed any sacrifice on their operations. This does not, however, overcome any effect of withdrawing their staff from civilian operations where contributions to the general welfare would be direct.

If, in fact, the volume of work now being undertaken by the Government, directly or through contractors, is undermining the general progress of the economy through diversion of a disproportionate part of the nation's scientific and engineering talent, this is a factor which should be understood. Then perhaps it could be taken into account in the policies under which work for the Government is performed in such a way as to minimize adverse effects. Clearly, there would be less feeling on the part of organizations that their work for the Government was proving harmful, if they felt that they were able to derive substantial benefits by retaining and applying know-how developed by them in the course of work for the Government for the advancement of their commercial operations. Indeed, to the extent that they were given incentive to do so, work for the Government instead of being a detriment to their regular activities, might be regarded as augmenting and supplementing them.

The second portion of the question concerned the extent to which work for the Government has affected the cost of the contractors' operations and their regular work. This inquiry was included because of the frequently heard assertion that work on Government assignments, especially work performed on cost reimbursement terms, has led to such competition for technical and engineering personnel that the cost, not only of individuals recruited for Government work but of others also, has been substantially raised. Likewise, it is the experience of contractors that the performance of Government work frequently requires the use of added measures of security, accounting, and other procedures which increase cost of operation.

It is significant that so large a proportion of those questioned answered that the performance of work for the Government had increased their cost of operation.

Question No. 12. Opportunity to Develop Know-How as Incentive to Undertake Work for Government.

Question No. 12, the last of the survey, inquired: "Does the opportunity to develop know-how or patent rights provide incentive to you to undertake work for the Government?"

Answers:

(a) Know-how—"Yes" 83%; "No" 13%; "Other" 4%.
(b) Patent rights—"Yes" 63%; "No" 28%; "Other" 9%.

This question was included in order to explore the motivation of organizations undertaking work for the Government. It seemed particularly worthwhile to make this inquiry to determine the impact of the varied patent policies of different Government agencies. It is quite clear from the responses that work is undertaken for the Government in the hope of acquiring know-how and patent rights. If this objective on the part of contractors is to be exploited or maximized in the interest of the Government, it is clear that regulations or contract terms which deprive the organization of know-how or patent rights will certainly adversely affect this motivation.

It is particularly pertinent that the more able the contractor, and the more relevant the organization's proprietary rights, the more directly will contract terms requiring surrender of know-how or patent rights act against the interest of the contractor. Accordingly, it would be the most appropriate potential organizations which would be most repelled from undertaking work for agencies of the Government which employ terms that are regarded as undesirable. This clearly does not serve the Government's primary interest in securing experienced assistance in prompt development of concepts and speedy and efficient implementation into operating systems. Moreover, experience has clearly shown that in the absence of proprietary or exclusive rights, the likelihood of new developments being brought to widespread commercialization is greatly reduced. Thus even the secondary interest of securing further application of technology developed on such contracts would be defeated by a policy which deprived organizations of incentive to make such utilization.

Consequences to Contractor of Undertaking R&D For The Government

(*a*) *The Function of R&D to the Contractor*

The United States and the free world believe in the virtues of free and fair intellectual and trade competition to keep their societies and organizations efficient and productive in the interest of their people. Under this philosophy each nation and each institution seeks progress

not by force, tariff, quota exclusion, or other form of protection, but by offering better goods and services. To reach the widest market, it seeks to improve its production and distribution processes so that its costs, as well as its quality, will be competitive. Thus, competition in concept and design, as well as quality and cost, is the life principle of the free economic system. Since constant improvement is an essential to success under this system, it is the function of organized R&D to provide the required flow of new products, services, and methods to each competing entity. This is the purpose and contribution of R&D to each contractor in the free competitive enterprise system.

Although in recent years it is becoming more usual for organizations to engage in research as a form of operation and an end in itself, in the majority of entities the R&D department is not really intended to perform in this way. Indeed, if it does so to the neglect of the needs of its own parent institution, it jeopardizes the survival of both the R&D function and the organization. Rather, it is the normal function of an R&D department to provide a continuing stream of improvements in existing products and processes, or to develop wholly new items or services, for the organization to offer its customers. This is the true utility of research in a competitive organization and it is desirable and necessary that it should be so. By this means, likewise, the public is offered increased value through improved products and services at costs which make them widely available. This is the true foundation of a "rising standard of living" and continued and secure employment for the staff of an economic entity. This too is the acceptable basis on which American enterprise must meet foreign competition.

Because of this service function of the R&D department, it is relatively undesirable for most contractors to engage in R&D activities which will not result in products and services to be produced by the other departments of the organization. As a consequence, it is entirely natural for contractors undertaking R&D for the Government to do so in the hope and expectation that the Government-sponsored R&D will provide opportunity for follow-on production. For this purpose, it is to be expected that the contractor will seek to retain inventions and technology resulting from its work and seek to apply them in all its operations. This is the normal functioning of the enterprise system. It can serve the Government's and the Nation's interest if the organization's work for the Government is performed under conditions which encourage the contractor to incorporate its best proprietary technology and know-how, and subsequently to utilize any generally useful developments in all its products and services.

In the light of realization that the general economy may be suffering from too great a diversion of R&D talent from civilian purposes, *or may be operating in ways which are impeding the flow of the results of the Government's huge R&D programs into the economy,* it is desirable to determine whether present Government policies may be contributing to the slowdown in the creation of new civilian technology and resulting employment opportunities. This is especially necessary with respect to the policies which affect the creative R&D functions of contractors and their motivation with respect to contribution of their technology to Government programs, and utilization of technology derivable from Government programs in products and services for the civilian economy.

(*b*) *Effect of Use of Scarce Manpower*

It is well known that the supply of scientists and engineers and other specialists required for truly effective R&D is limited. The extent of this limitation can be judged from the fact that in 1962 only approximately 400,000 professional scientists and engineers out of a population of 180 million were devoted to all types of R&D, private and public. Even more telling is the assertion that, of all persons engaged in R&D, really major new developments spring from only 200 or 300 significantly creative individuals. All others are concerned with problems of application and working out the details of the conceptions originated by the small group. These statistics are provided by the National Science Foundation in the first instance and by the President of the Logistics Management Institute of the Department of Defense and have not been challenged.

According to analyses of Government agencies, Federal Government projects engaged 70 percent of all scientists and engineers employed in R&D in 1962. This means that of the 400,000 total professionals engaged in R&D in that year, 280,000 were devoted to Government projects and only 30 percent or 120,000 were available for private sector problems. It is now widely questioned whether this use or diversion of R&D personnel and effort from programs of general application to the economy is not responsible in part for the slowdown in the economy and the continuing high level of unemployment. It is significant that, as shown in the answers to Question No. 11 of the Questionnaire, a sizeable preponderance of organizations state that work for the Government has slowed down the introduction and promotion of commercial products. For further related aspects, see below.

(*c*) *Effect on Contractor's Commercial Business*

The effect of Government projects in drawing scarce R&D manpower away from commercial projects has been indicated by the statistics cited above. However, in the experience of a number of contractors, the impact of Government R&D on their private operations is magnified in other ways as well. This is said to come about through the scientific and engineering appeal of many Government projects, and particularly the extent to which such programs are operated with finer, more ample, or more recent laboratories and equipment. Likewise, it is asserted that the approximately one-half of private industrial research which is devoted to improvement of existing products and processes is aimed at cost reduction and only modest improvement in civilian goods and services. Even though cost reduction is necessary and desirable, it is alleged that this type of work holds less professional appeal than the challenges of nuclear energy, space conquest and the achievement of major advances in defense systems. For whatever reasons, many responsible private organizations assert that they find it difficult, if not impossible, to staff adequately for their commercial R&D. Likewise, they find the costs of such staffing, and the demands for facilities and equipment comparable to those used by the professionals engaged in Government-sponsored R&D, to be so costly as to make it increasingly difficult to use R&D for private purposes.

There are private directors of research who deny any inadequacies of their commercial work or environment. Nevertheless, the results of the questionnaire, specifically the answers to Question No. 11, but

even more clearly the results of interviews, definitely indicate that in the experience of many contractors, the devotion of R&D and other talent and facilities to Government work has in fact slowed down or otherwise adversely affected their production of commercial products. It has likewise raised their costs of operation. These effects certainly have their impact on the economy. Actions which could be taken by the Government to minimize adverse effects of this type are discussed below.

One further effect of Government patent policy which cannot be overlooked is its effect on the willingness of personnel to be assigned to work for the Government. This situation is not always clear because frequently the Government assignment is quite challenging from a scientific, engineering or other professional viewpoint. On the other hand, if relatively low rates of profit and return on net worth are earned by working for the Government (as is borne out in other studies), a policy which denies to the contractor title to inventions or opportunity for exclusive rights to commercialize such rights, further lessens the attractiveness of Government work. Likewise, because most organizations reward their employees in proportion to their economic contribution to the organization, it is a fact that in a number of desirable organizations, those responsible for administering Government work find difficulty in staffing Government projects with desired personnel. Resistance is met both at the administrative level and on the part of professional employees themselves, who see bonuses and promotions threatened by removal from the commercial effort of their organization and assignment to Government projects.

(d) The Significance of Patents and Technology to Contractors

Responses to Question No. 1 of the questionnaire indicate that many contractors depend on patent rights for their commercial position, which for many is their very existence. The answers reveal that this is of vital concern. Individuals familiar with such entities can readily understand this situation. Many organizations have sprung from an inventive concept or a newly developed technology. To the public this provides new or improved products or services, and is the source of jobs, income and tax revenues.

Outstanding examples of the importance of patents to commercial organizations are many, but can perhaps be illustrated by citing the example of the Land or Polaroid cameras. In this instance, patents permitted a new and small organization to become a major factor in the photographic industry in the face of the well-established market positions and economic strengths of such giant competitors as the Kodak Company and General Aniline and Film Company. Similarly, new technology making possible the production of glass fibers was responsible for the Fiber Glass Corporation and several new members of the industry with attendant introduction and availability of fireproof drapery, insulation, plastic-glass laminates and a host of new products. The development of nylon by the DuPont Company is another striking example of new and patented material created only after substantial investment—in this case, stated to be many millions of dollars—which has made a definite and continuing contribution to the welfare of the public. The fact that the new products have been profitable for their developers and sponsors in no way denies their wide public benefits. Rather, it is the plow-back reinvestment of the profit above immediate costs which has made possible the improvements and large scale availability and usefulness of the products.

The report describes eight companies derived from newly developed technology. In the interest of brevity, this portion of the original is eliminated.

Objectives of Government Contracting for R&D

(a) *First Things First—Wanted: Weapons, Space Systems and Tangible End Results*

Having briefly examined the value of patents and proprietary technology to contractors, it is well to emphasize the objectives of the Government in contracting for R&D. In doing so, particular attention will be paid to learning whether the purpose of the Government requires that it own or control patents and technology in the interest of the Government itself or the interest of the public at large.

In the establishment of Government patent policy regarding the ownership of inventions, and in demands by the Government for technical data developed by contractors on Government-sponsored work, it is essential for all parties not to lose sight of primary objectives. This becomes all the more important when it is desired to obtain extensive utilization of technology derivable from Government-sponsored R&D. When the Government contracts for R&D, almost never is the primary purpose the obtainment of patents or even technical data for its own sake. In almost every case, what is sought is tangible end item—a weapon, a detection system, military atomic energy, a space vehicle or some functional component.

The objective of Government contracting for R&D has been very clearly stated by the Government itself. In a statement of Deputy Assistant Secretary of Defense for Procurement Graeme Bannerman to the Subcommittee on Patents, Trademarks & Copyrights of the Senate Committee on the Judiciairy on April 18, 1961, he stated:

> But it is clear that there has been a tremendous increase in research and development activity in the country, much of it funded by the Federal Government.
>
> While what the proper patent policy for the Government should be in these circumstances can be discussed from a number of points of view, some social, some economic, the Department of Defense has always regarded certain practical considerations as compelling. These were expressed quite concisely in a letter dated November 10, 1949, from the then Secretary of Defense, Mr. Johnson, to the Director of the Bureau of the Budget, which I will quote from:
>
> "Now, the Department of Defense conducts research and development activities on a scale far larger than any other executive department. Moreover, these activities are different in kind from the research and development work of other agencies. Whereas most of the research and development work of other agencies is directed toward securing a direct benefit to some aspect of civilian life, military research and development therefore are merely by-products. Although clearly the Government should not throw away these by-products, we should not lose sight of the primary purpose involved.
>
> "The bulk of the Research and Development activities of the Department of Defense are carried on by nongovernmental organizations under contract. In selecting contractors for military research and development, it has been proven more efficient and economical to utilize for applied research and development those organizations which possess the most relevant background in knowledge, techniques, and equipment. About four-fifths of the contracted research and development work is therefore done by industrial organizations and we must negotiate the best arrangements possible with them. Our present policy for such contracts has been worked out over many years of negotiation. Although it is plain that they should not be considered immutable, sudden and sweeping changes would certainly disrupt the contracting operations of the Department of Defense."
>
> Today we wish to restate and endorse this historical position in opposition to a rigid policy of taking title to all patents which are conceived or first reduced to practice under our research and development contracts.

PRACTICAL CONSIDERATIONS FOR THE LICENSE POLICY IN DEFENSE CONTRACTS

At the outset, I wish to make clear that I am talking about the area where substantially all the patentable inventions derived from our contracts occur; that is, in the development of military hardware. It is in this field that our patent policy has the greatest effect.

The national public interest is heavily and most importantly identified with the defense structure. National defense is the responsibility of the Department. To discharge this responsibility, we seek the best scientific and technological resources we can find, and our research and development contracts must necessarily be awarded to the firms—large or small—which have these resources and will freely devote them to military work. Our primary aim is to acquire military equipment incorporating the most advanced scientific knowledge, technology; and industrial know-how for military purposes. It is necessary that science and technology be pushed to the absolute limit.

Our objective in these major programs is the rapid development of constantly improving weapons. We are not seeking patentable inventions, the likelihood of their occurence is unpredictable, and whether they do or do not occur is actually irrelevant so long as our development goals are achieved or surpassed.

Since it is weapons, space systems and other tangible end results which are sought by the Government, the successful obtainment of these objectives should be enhanced by the Government's procurement, patent and data policies. For this purpose, these policies should attract rather than repel competent contractors with pertinent background and experience. Policies which discourage such organizations from undertaking R&D for the Government are injurious to the nation's best interests. While they may not result in complete unavailability of all contractors, they do deny the Government the advantages of enlisting organizations already knowledgeable in the field and able to bring to the governmental purpose the previously trained personnel, existing technology and support of subcontractors accustomed to team work with the prime contractor.

It is quite clear from the responses to Questions #5 and #6 of the Questionnaire that contracting policies, and particularly patent and technical data policies, which are considered by contractors to jeopardize their commercial position or to demand that they share their technology with others, do in fact discourage competent organizations from dealing with Government. When such organizations undertake such work for the Government, despite reluctance to do so, they are likely to isolate the Government project, place it in a separate division of the organization, or in other ways segregate it from the sections of the company best able to contribute existing relevant technology and guidance. This is to the detriment of the Government project. Surely this method of contracting, even though some organizations can be found which will accept the terms, is not in the nation's interest. Certainly the policies which lead to this method of operation should be reviewed to determine whether alternative procedures can provide adequate protection of legitimate public interests at the same time that they enlist the enthusiastic support of desirable contractors. Only in this way will first things come first—the best, prompt and effective solutions to the genuine and pressing problems of Government and their rapid implementation into functional systems—rather than the efforts of organizations of no background with nothing to lose which must first acquire the necessary basic understanding at Government expense.

(*b*) *Maximizing Secondary Benefits*

Now that the Nation faces problems of continuing unemployment, and it is possible that these difficulties may arise in part from diversion of R&D effort from civilian purposes, attention is being given to methods by which technology or other useful results could be derived from Government-sponsored research and transmitted to the private sector. If it is sought to have the private sector utilize the results of military and similar technology, it would seem preferable to have this technology arise within the private sector. Under these conditions there would be fewer problems of communication and transfer and only the difficulties inherent in utilization. Accordingly, these considerations should influence procurement policies, including the decision whether or not to perform the work inhouse in a Government establishment and who should own inventions and data arising from Government-sponsored R&D.

(*c*) *Assurance of Competitive Supply and Multiple Sources of Procurement*

A proper concern of all Government procurement, and especially that performed upon a cost reimbursement basis, is the need to secure the benefits of competition in keeping costs at a reasonable minimum. Some Government administrators believe that the greatest assurance of such competiton lies in the use of multiple sources of supply. Price competition is the normal mode of operation in the private sector. However, normal competition is competition of concept as well as price. Seldom does it involve use of an organization's own data by a competitor. Even this form of competition, if incurred only in serving the Government, would be acceptable if such operation did not threaten the civilian and proprietary business of the original contractor. Accepting the desirability of competition in supply to the Government, it is not considered necessary that the enlistment of second sources should require the adoption of undesirable patent and technical data policies. Reasons for these conclusions are indicated below.

(*d*) *Government's Dependence on Private Proprietary Rights and Technology*

The extent to which defense and other undertaking by the Government rely on private technology for their early, efficient, and satisfactory performance has been indicated above in the statement of Assistant Secretary Bannerman. The answers to Question #2 of the Questionnaire confirm this. DOD has explicitly stated that in its quest for contractors to develop weapons and other items, it turns whenever it can to contractors already possessing know-how applicable to the Government's needs. This is as it should be. The same can be said in almost all areas. Enlistment of existing sources with know-how will both accelerate progress and will reduce costs by not requiring the creation, staffing and training of new teams.

The Department of Defense and the Services have been engaged in dealing with contractors on a larger scale and for a longer period than any other agency of the Government. They have accordingly had opportunity to sense the reactions of organizations in their relations with the Government. It is believed that their experience and conclusions provide very relevant guidance in this complex field. Con-

tinuing his testimony before the Subcommittee on Patents, Trademarks and Copyrights on April 18, 1961, Mr. Bannerman, Deputy Assistant Secretary of Defense for Procurement, stated as follows:

The end products of most defense contracts are developed weapons or components thereof. It is not usual for these end products, themselves, to have any commercial utility, or patentability. When patentable inventions do occur during the course of such contracts, it is likely to be with respect to small segments of the complete contract involving specific components frequently at the subcontract level. It is normally not possible to segregate and evaluate either that portion of the Government's cost which pertains to the specific invention or the specific background work previously performed by the contractor at his own expense which led to the invention.

In selecting contractors for research and development work, it is the expressed policy of the Department of Defense to make awards to those organizations which have the highest competence in the specific field of science or technology involved. This is done because, by seeking the organization which is most advanced in the field, we avoid repetition of effort and thereby get our weapons developed on a quicker and less costly basis. It should be recognized that this means that we seek out our development contractors and subcontractors because of their specialized skills and backgrounds which were normally acquired at their own expense for use in their own commercial pursuits. It is essential to the national defense that these specialized firms and their best background ideas and prior investment be freely available for weapons development.

We move in on these laboratories. We select these laboratories for work because of the advanced work that they have done. That is our basis for selection. That advanced work was done for commercial purposes; and if we thereafter take the fruits of that work, added, perhaps, to a minor extent, perhaps, by our contract, and make it available with free, patent title, I think it is fair to say that that work will not be devoted to our contract in many cases.

Some companies see the potentials of follow-on production programs as a real factor and inducement. Economic necessity may drive others to accept our contracts. There are many firms which would be glad to have us finance their entry into new fields in which they have no prior experience on any terms they can get. It is readily apparent that there are substantial motivations, exclusive of patent fallout, in undertaking research and development work for the Department.

However, many of the most competent industrial laboratories which have done the most advanced work in fields of interest to us are not normally for hire to develop products for others to make commercially. Our goal is not the mere placement of research and development contracts but the placement of those contracts with firms currently developing the most advanced technology. It is vital, in our considered view, that such firms freely accept DOD contracts and put their best technical effort and background ideas wholeheartedly in problem solutions for national defense. The Government has no power to compete with this. It is a matter of mutually agreeable terms which appear to offer advantages to both parties.

The motivations and incentives involved in contracting for military research and development work are complex, subtle, and varied and the division of patent rights is a significant consideration. We need the understanding and support of Congress to discharge effectively our responsibility, cooperating as we are in a free enterprise economy which includes a patent system. We feel that the national interest would not be served by a policy of taking title in all inventions resulting from the performance of defense research and development contracts.

As stated so explicitly by the Department of Defense, the Government in placing contracts for R&D is not seeking patents or even inventions. Its interest is in effective systems, services and tangible items. As acknowledged before, the Government must have the right to use developments and to be assured of the benefits of competition in procurement. But ownership of patents, involvement in their exploitation and further development and use, is a diversion from the proper purposes and concern of DOD, AEC, NASA and nearly all agencies of the Government.

(e) Patents and Technology as Incentives to Seek Government Contracts

While it is clearly in the Government's own interest to place its work with organizations which are already established in fields related to the Government work, this in no sense denies that organizations frequently perform creditable services for the Government while undertaking work in fields new to the organization. Nor, is it necessarily bad faith on a contractor's part to undertake such work. Providing the organization exercises diligence, good judgment and devotes or acquires real competence in the fields, the interests of both the Government and the contractor can be served. Moreover, some fields of interest to the Government will, in fact, be novel to almost all contractors.

As indicated in the response to the Question No. 12 of the Questionnaire, the opportunity to acquire new fields of technology and, hopefully, new patent rights does comprise an incentive to contractors to undertake work for the Government. For this incentive to be effective, it is imperative that Government patent policies reward pioneering service. To provide such motivation, the Government should require of contractors only minimum rights necessary in the direct interest of the Government.

(f) Requirements for Widespread Public Use

As indicated in the response to the Question No. 12 of the Question-Patent Memorandum, it is desirable that Government patent policy promote widespread secondary use of development flowing from Government-sponsored R&D. Accordingly, it is relevant to examine the extent to which proposed policy assists or deters widespread public use of inventions and technology. To provide employment opportunities, and to keep U.S. products and services competitive through advances in concept and cost reduction, it is desirable that applicable inventions and technology derivable from Government-sponsored work be put into use by the private sector to the maximum extent. For this to occur, it is necessary that (a) the new developments be communicated as promptly and as effectively as possible to potential users; and likewise (b) that there be incentive for further effort and expenditure by the private sector to adapt the technology and make the product or service, plant and distribution investment necessary to achieve widespread use for nongovernmental purposes.

It is obvious that communication will be facilitated if the new technological developments are made within the private sector rather than in Government establishments, educational institutions or non-profit organizations not regularly engaged in commercial production or distribution. Likewise, it is evident that incentive to make further investment and to devote the necessary effort to adapt or use the new development will be greatest if the new data or inventions are owned by the private developers and potential users. When this is so, their use is the normal sequence for private R&D and constitutes logical opportunity for investment by the developing organization and its backers. To the extent that proprietary rights are precluded or diluted, this incentive is reduced and negated.

(g) Likelihood of Commercial Use as Affected by Ownership

Although as yet not a common practice, there is beginning to be an affirmative effort on the part of competitive organizations to review the results of their R&D and patent efforts to see whether secondary benefits can be derived from them. Sometimes the motive is primarily economic; at other times it is intended to provide recognition and stimulus to their personnel. Under programs of this kind, companies periodically examine patents and other proprietary data owned by them to see whether any of these could be utilized outside the organization's fields of primary interest. Checks with companies engaging in this practice make it quite clear that it is only development owned by them which receives this type of review and effort. Accordingly, if title has been taken by the government, the patents and other developments will not be included in material which receives review and further effort at utilization. In consequence, likelihood of use will be reduced.

The Respective Contributions of the Inventor and the Entrepreneur

(a) The Separate Roles of Inventor and Entrepreneur

In discussions by Government representatives of the value of inventions and of policies to their ownership, it is altogether too common to overlook the fact that very seldom is the inventor by himself able to bring his new concepts into use. The personality and interests of inventors which provide them with curiosity and special insight into the phenomena of nature, or the ability to make comprehensive analyses of industrial or technical problems, is frequently quite foreign to the requirements for creating a production organization and establishing a distribution and marketing system. This is no criticism of the inventor. Without his creative concept, following from insight into the problem, or his interest in analyzing complex situations, there would be no novelty. But equally, without organization genius and the promotional drive of the entrepreneur, there would not come into being the human, material, and economic resources required to put inventions to use. Without this team effort of inventor and entrepreneur, there would not be the goods and services which are the only means by which new inventions actually reach and benefit the public.

(b) The Requirements and Comparative Investments and Risks of Each

It is necessary to recognize the respective roles and requirements of inventor and entrepreneur even when these functions are carried out within a single organization. The requirements of each differ but must be met if inventions are not to be mere library or laboratory curiosities and are to be carried forward into new or improved commodities or services.

Although the costs of invention, development and exploitation vary greatly with each concept, it has been generalized that the relative costs experienced in each stage of providing a new product or service fall in approximately the following proportions:

(a) For each $1 spent for invention, approximately (b) $10 is required to reduce the invention to an effective working form and (c) $100 is required for creating the productive facilities the inventory,

and the distribution and acceptance necessary for development of the market.[1]

This gives some conception of the comparative contribution, investment and risk assumed by the inventor and by those who undertake to promote his invention.

The classic stories of inventions made in garrets or basements illustrate the relatively low direct cost of creating new concepts or reducing them to a form in which they can be communicated. In modern establishments, the "inventive cost" may be considered the costs of the laboratory and patent effort. There then follows the long process of developing and "debugging" an acceptable reasonably reliable and "foolproof" commodity or service to be used by the general public. Then must come the assembly of the tools and facilities and the creation of the inventory needed to provide the item in sufficient quantity to test the market reaction. This may show need for redevelopment and modification. Ultimately the item, if acceptable to the user, must be produced in quantity and distributed to wholesalers and retailers in order that it can come within reach of the buying public.

It is altogether too easy for those not familiar with the many and demanding requirements for launching new products and services to think only of the rights or requirements of the inventor, or even of the inventor and his sponsor. However, it is fatal to overlook the needs and risks of the many other parties including managers, producers, marketers and investors, in making possible the actual creation and distribution of useful items actually available in the hands of the public. Sound patent policy must meet all these requirements if its results are to be successful.

(c) Function of the Patent in Attracting and Protecting the Entrepreneur

As has been suggested, in addition to the inventor, many others must devote their time and savings to the promotion of new concepts if they are actually to be transformed into useful products and services. When it is realized that the proportion of inventions which prove to be successful is extremely small—evidence indicates less than 5 percent—it must be realized that there are substantial risks of loss of time, effort and funds involved in each attempt to launch a new product or service. That inventors continue to invent, and sponsors can be found to back at least a portion of these inventions, is tribute to the observation that "hope springs eternal."

In addition to all the normal hazards to new developments, including failure of the invention to prove workable, or producible at economic cost, human resistance to change and fickleness of fashion, there is a further major and ever-present risk to which any new product or service is subject. Should the concept prove to be good and gain acceptance, it is certain that others will seek to copy it and try to gain as much of the market as possible. If the inventor and his backers have incurred substantial costs for the initial inventive effort and its development, production, and distribution, it is essential to their survival that they be given opportunity to recoup these costs. This is mere equity to those involved. It is also necessary to encourage others to promote other new developments.

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[1] See *Machine Design* August 22, 1957; "Using Ideas from Outside Inventors" by George S. Hastings; *Dun's* Review June 1958; "Building Profits on Outside Inventions" George S. Hastings; and presentations of William Davidson and Robert Olson to American University Patent Institute November 21, 1963.

The normal way in which inventors and their backers are given protection in our competitive system is for the inventor and his sponsors to obtain a patent to assure the originator and his associates of a limited, clearly defined right to exclude others from using the patented invention. This protection is granted in exchange for a disclosure and publication of the essentials of the invention in such terms that they can be understood and used by others upon the expiration of the patent. It should be noted that the patent disclosure permits others to understand the invention immediately, not upon the expiration of the patent. The patent system, therefore, encourages openness and disclosure as contrasted to reliance upon secrecy. In doing so, they permit immediate, informed stimulation of competitors who are shown the basis of the novelty and the limits of protection around which they must invent.

In the U.S., it is still possible for an inventor and his sponsors not to seek patent protection but rely upon "trade secrets"—that is, their ability to conceal the methods and principles upon which the new service, product or process depends. To date, however, the nation has followed a tradition of resort to patent protection and open competition rather than secrecy. The patent system and the private ownership of patents, in providing recognition and reward to the originators of new and useful inventions, at the same time has encouraged legitimate, keen competition through enabling others to learn the principles of the new invention and the limits around which others would have to design in order to escape the limited exclusivity of the patent. It is now open to serious question whether present Government patent policies are fostering a trend away from open disclosure.

Experience in financing new developments clearly reveals that banks and stock brokerage houses are more inclined to provide funds to an individual or organization which possesses patent protection for the concepts to be financed, than they are willing to support unpatented inventions. The history of many well-recognized organizations in the country attests to this fact. The history of the Polaroid Corporation is clearly illustrative—they were refused financing before obtaining patents because of the lack. and secured it after patents were granted. Examples can be multiplied. They all demonstrate that it is the small inventor and new business which benefits most from patents since they still lack general credit and must rely on patents for the necessary financing to launch the business or make it grow. It is only the large organizations, whose general assets can provide the credit, or whose advertising and selling strength can perhaps move their commodities without reference to patented advantages, who are perhaps less dependent on patents, although still using them to recoup development and introductory costs or in trading for exchange of rights.

Experience in Getting Inventions and Technology Used

Part of the concern of the nation over the development of Government patent policies is directed to assure that as far as possible any useful results obtainable from Government-sponsored R&D will in fact be put to use in the public interest. This was evident before but is explicitly stated in the National Aeronautics and Space Act and in the President's Patent Memorandum of October 10, 1963, In this concern, it is evident that the Government, represented by various executive agencies, undertakes to represent the public. From their attitudes

and dealings, it is clear that some of these agencies consider that contractor retention of ownership of inventions or technical data resulting from Government-sponsored work is somehow adverse to the public interest. This is a strange attitude in a country which assertedly relies upon private enterprise and from its outset proposed that there should be a minimum of Government. It is contrary to the concept that all responsibility not specifically granted to the Government should remain with the people. Despite this premise in our constitutional history that maximum reliance should be placed on private responsibility and initiative as the primary resource and strength of the nation, it is a fact that an increasing number of legislative acts in this field accept that assumption that private interests, and expressly those represented by contractors, are in some way in opposition to the public interest and that it is therefore incumbent on the Government to protect and promote "the public interest." Government retention of title to patents and the acquisition of rights in technology by the Government are frequently asserted to be necessary for this purpose. Ironically, most foreign governments take a contrary attitude.

(*a*) *Government Experience*

In view of this position of the U.S. Government, it is of particular interest to analyze the success of the Government in promoting the use of inventions and technology. Inventions and technology even if owned by the Government, do not in fact convey any benefit and thereby promote the public interest unless put to use and made widely available in tangible form as products and services. Mere availability for license, or "dedication to the public" is of little utility to any one and experience to date indicates that such a policy actually militates against use and development.

Insight into the Government's effectiveness or lack of effectiveness in securing the use of Government owned and licensed inventions can be seen from the available statistics. Although the data is not easy to obtain because of its many sources, it is now reported that the Government owns approximately 12,000 patents. Of these only 1,487 have been licensed, and of those licensed, only relatively few are considered to be in actual use.[2] While there are many reasons for this, including the essentially military or other specialized nature of many of the inventions owned by the Government, it would nevertheless appear that with so many patents and related technology owned by the Government, a larger number should be in use. Since this is not the case—for whatever reason—ownership of patents and technology by the Government cannot be taken as assurance that this will result in utilization. As a matter of fact, this has been the experience of both the United Kingdom and of Canada where Government agencies have sought to promote civilian application of Government-owned inventions. In both of these countries, utilization has been minimal and the costs incurred by the Governments for the purpose has substantially exceeded revenues received from the effort.

To date it has not been seriously suggested that the Government itself should engage in production or distribution of civilian type goods or services. Accordingly, it is not seen how Government agencies could themselves effectively promote the public good in this way. Rather, it must depend on private and for the most part industrial and commer-

[2] Mary A. Holman, "The Utilization of Government-Owned patented Inventions", *PTC J. Res. & Ed.* (*IDEA*), Volume 7, No. 2 (Summer 1963).

cial interests to produce, distribute and provide the goods and services. For the private sector to perform this function is quite natural since it is the manner in which our economy operates. It is likewise consistent with the basic precept that it is the business of Government to govern but not to engage in the promotion of private goods or services and certainly not in their direct production, distribution or sale.

(*b*) *Experience Under Private Ownership and Exploitation*

In contrast to the failure of Government-owned inventions to be put to civilian use is the widely accepted assertion that a very much higher proportion of privately owned patents and inventions are put to use. Here again statistics are difficult to obtain but such information as is available (see *The Patent, Trademark, & Copyright Journal of Research and Education* (IDEA), Volume 4, Number 4, Winter 1960) indicates that the percentage of patents privately owned which are put to use is four or five times higher than for Government-owned patents. Again, this result could follow from many causes, beginning with the fact that the patents which are privately owned are undoubtedly more frequently directed at commercial objectives. They are therefore, inherently more likely to be useful for commercial products and services. However, it seems inevitable that there is an incentive on the part of the private owner to derive value from costs incurred which is absent under Government ownership, particularly when the private sector use is an aside from the military, space or other primary Government purpose. The fundamental motivations of Government and the private sector are quite dissimilar and each is suited to its primary purpose and unsuited to perform the functions of the other.

A further factor, and one which is commonly accepted in private practice and is certainly material insecuring private use of patented inventions and technology, is the employment of "exclusive use" as a basis for incentive and protection to the individual or the organization which will run the risks and costs of launching a new development. It would seem to be difficult if not politically infeasible for a public official in dealing with public property to give a single private party the sole right to exploit a development. Especially if the organization seeking the right to use is large, the grant of exclusive rights by the Government may be difficult indeed. And yet in the absence of a suitable user and incentive to it to make the further investments required, it is almost certain that a large number of new and unproved developments will not receive the experimentation and further development and adaptation required, and will therefore lie fallow or fail through lack of expertise or strength in their promotion.

Some Basic Problems in Securing Use of Government Patents and Technology

It is universally agreed that it is desirable that as much benefit as possible be obtained for the general economy from the R&D conducted initially for Government purposes. To achieve this end, however, it is essential that the problems and obstacles be evaluated with utter realism. In no other way will it be possible to distinguish meaningfully between the results sought and the steps required to achieve them, and to develop sound public policy for this purpose.

As suggested in Section VII, to carry any concept from vision to reality requires much effort, much added cost and considerable knowl-

edge and persistence in the field to which the invention relates. Without devotion of dedicated energies, seldom will the inertia to change, as well as general lack of ability to visualize in advance new and different courses, produce new ways or ready acceptance of those offered. To help evaluate the problems of getting new concepts, and new technology used, this section examines some of the major problem areas.

(*a*) *Inherent Difficulty of Subject Matter and Communication*

As is immediately apparent on giving any serious consideration to the subject, there are many and difficult problems involved in obtaining widespread use of technology developed in the course of work for the Government. From the outset, it will be recognized that the end items sought by the Government are usually weapons systems, space craft and the like, rather than civilian commodities. Accordingly, it is only in some specialized fields that the complete military or space package will have acceptance in the civilian market. Rather, it must be expected that it will be the technology, and possibly components of the Government end items which can be applied and find use for the general public.

Moreover, there are enormous problems in communicating the subject matter of technology and end products developed for Government agencies to organizations and members of the public in such a way as to lead to their utilization. At present, many efforts are under way to improve this communication. The Scientific-Technical Abstract Reports and other publications of NASA are an effort in this direction. The activities of the Office of Technical Services of the Department of Commerce and the Defense Documentation Center are both intended to disseminate reports and information developed on programs for the Government to proper recipients and thereby encourage their use. Considerable attention is being paid to determining how the dissemination of publications can be supplemented by people-to-people communication in the form of seminars, rotation of personnel, and by other means. Difficulties of transmission and acceptance of knowledge, even within the organization which performs work for the Government, are under study and all disclose formidable obstacles to the efficient use of possible helpful by-products of work undertaken for the Government which, from the outset, was not aimed at producing civilian commodities or services.

(*b*) *Required Further Know-How, Effort and Cost*

Experience has clearly shown that the mere availability of useful information will not of itself produce new products and services. The information must be recognized as useful to meet a need or serve a purpose. But even then utilization will require very considerable know-how and effort for its application. Between concept and product stands a great gulf that can only be filled by multi-faceted, expertise and dedicated effort. The types of know-how required may be quite unrelated to the problems of the inventor. For example, it is necessary to know what is the civilian need or opportunity which can be served with the new information. What is the size of the market. In what form, price range, degree of complexity, styling and the like should the product or services be offered. How much will it cost to advance the concept or data from generalization or concept to a tangible, acceptable product. What plant and production force, what distribution arrangements and what inventory is needed and how can they be fi-

nanced. The expertise required includes knowledge of the specific kind of market, type of product, competitive situation, and ability to bring together the resources required for development, production, distribution and financing. All of these are formidable in managerial as well as financial requirements.

(*c*) *High Mortality of New Concepts and Products*

In the light of the many difficulties inherent in proceeding from new concept to finished product, it is not surprising that new ideas have a high mortality. Statistics in this field are so discouraging that little novelty would be offered but for the fact that hope springs eternal and the rewards can be high. Previous studies suggest that on the order of one concept per thousand proves to be a successful product or service. Other data dealing with the utilization of patents, as distinguished from mere ideas, indicate that only between 2 and 8 per cent of patents actually produce successful products or services and significant income. This data should be distinguished from other findings which suggest that patents are "utilized," i.e., employed for trading purposes, mentioned on labels, or otherwise. We are here concerned with the production of useful end items which generate jobs and revenue and the available information indicates that, even when a concept has received the further attention necessary to secure a patent, its chances of significant success are few, hardly more than 5 per cent.

As can be judged from the preceding section, and as is known to those experienced in the field, many products and services of inherently good value languish and do not succeed despite inherent merit because of failures of production, distribution or inability to bring inventor and financing together in an effective team. While such failures may not be the fault of the original concept, they nevertheless prevent the materialization of the new idea into anything useful to the public. The end result of all these factors is a high mortality rate for new concepts and attendant substantial losses of effort and expenditure devoted to the launching of new products and processes.

(*d*) *Necessity for Favorable Terms and High Rates on Successful Few*

In the light of the large number of ideas, and even patents, which fail, it is evident that, if the economic system is to move forward, those few concepts which do prove successful must yield a return high enough to cover the costs of the many which required expenditures but which produced no significant income. Happily, this has been the experience of a number of glamor products, nylon being a striking example. As a result, inventors are inspired by the hope that their brainchild will prove to be one of the successful few.

If, in fact, 5 percent of patents or 1 percent of ideas must recoup the costs of all the others, it is evident that favorable terms must be secured through licensing or as the purchase price. In view of the requirement of significant invention for developing the concept and getting it into wide-scale production and distribution, it is essential that the economic risks be compensated by adequate return. This, too, speaks for favorable terms, whether as price or royalty arrangement. In the free economic enterprise system, such terms are obtained or the concepts do not secure backing. It is questionable, however, whether under Government Administration terms would be permitted that would realistically deal with the uncertainties and losses inherent in the introduction of new products and services.

Statistics of business failures likewise reveal how many new and small organizations fail each year. Under these circumstances, it is clear that to compensate the owners and the backers of new products and processes, it is essential that successful instances be allowed to earn rates of return which can compensate for the more numerous instances of failure and fruitless expense. Here again it would seem evident that it is better for the effort to promote new developments to rest with private interests and thereby derive the personal interest, understanding and drive of the inventor, entrepreneur or other venture promoter. And likewise that the failure and loss, if any, fall on these private interests rather than become a public expense. In turn, it would seem preferable for the high rates of earning in the few instances in which they will occur to take place through private arrangements rather than under licenses or other arrangements negotiated by Government agencies with private interests. In other words, it is essential that successful inventions provide high return to compensate for the failures of other concepts, but it is probably politically better that the Government not be a party to assisting private interests in securing these high rates of return.

(*e*) *Problems in Selecting Concepts to Promote and License*

As has been indicated under (c) above, experience shows that a very small proportion of concepts, and even of patents, will in fact prove successful. This means that an incredibly large proportion of concepts and patents, running perhaps as high as 95 percent of the latter, are doomed to failure and should not receive serious expenditure and promotional effort. But no one can tell in advance which concepts will be successful. Every inventor hopes that his will make it. Nevertheless, experience shows that a large part of effort and cost will in fact come to nothing. Under such circumstances, and particularly since it requires unlimited and dedicated effort to make the difference between success and failure, it is most desirable that the selection, early development and promotion of concepts be left to the inventors and their associates for initial cultivation or elimination. Were a public agency to enter these functions at this stage, it would be extremely difficult to decide whose concepts should be given attention and support and whose eliminated and at what point. Indeed, to require a public agency to make such decisions would seem to be placing it in an impossible position.

(*f*) *Difficulties of a Centralized Every-Subject Promotion Agency*

As indicated above, in addition to financial support and dedicated effort, to be efficient and successful new concepts and technology must be promoted by individuals possessing the appropriate expertise and contacts. This means that they should be familiar with the field in which the concept or technology can be utilized. Unless they possess realistic familiarity with these areas, they will either fail to realize the possibilities for use of the concept and technology or will be quite inefficient and ineffective in seeking to advance it to utilization. When inventors and their backers undertake promotion, it is of only indirect concern to the public whether such activities are efficient or effective. Failure and loss falls primarily on the inventor and his associates.

However, if the promotional agency is supported at the direct expense of the public, it becomes essential that its costs be as reasonable as possible and that therefore its operations be efficient and effective. It seems almost inconceivable that any centralized agency of reasonable size could possess the required range of know-how and familiarity with industrial, commercial and financial operations to handle the full range of technological markets, potential sponsors and financial interests required to deal effectively with the developments which are generated by the programs of the large Government agencies such as DOD or NASA.

Some Unobvious Benefits To The Government And The Public From Widespread Use

(*a*) *Lower Costs, Availability of Parts and Service, and Continued Development*

It is believed that some of the Government's attitudes toward contractor retention of ownership of inventions and technology arise through a failure to appreciate the direct benefits to the Government and to the public which follow from active and continued use of cdevelopments by the contractor. It is clear that if equipment developed for Government purposes can be put into general use, the larger volume produced will result in lower production costs while reliability will undoubtedly increase. Moreover, widespread use and distribution will require the stocking of parts and provision of maintenance services. This will greatly enhance the utility of such equipment to the Government as well as to the general public. This is the history of all standard parts and catalog items. Automobiles, electric motors, and a host of items used by the Government and the public illustrate the benefits to all parties of large volume production and wide distribution.

But there are other less obvious but nevertheless real benefits. If items become a regular part of a contractor's business, they will receive the benefit of continued development and the cumulative experience of the organization based on use under a variety of circumstances and operators. This will require increased ruggedness and reliability. Thus, it is of direct benefit to the Government. In contrast can be seen the harmful effects to the Government if equipment remains so low in volume or so specialized in characteristics that it undergoes no continuing development, no exposure to varied circumstances and users, and cannot be serviced by regular suppliers and maintenance personnel. Under these circumstances, the equipment and its servicing remain special, all costs must be borne by the Government, and even then, in the absence of extensive and continuing experience, the equipment and service are not as efficient.

(*b*) *General Contribution to the Economy*

The above benefits to the Government are mentioned first because they comprise direct contributions to the interest of the Government itself resulting from wide-scale and public use of equipment or services initially desired for direct Governmental functions. Of course, no evaluation of the interest of the Government in inventions and

technology is sound unless it takes into account the interests of the general public. Thus, it is clear that new products and processes, if put to extensive use, confer at least the following additional benefits on the public and the Government:

1. They create job opportunities with resulting income to individuals;
2. They result in plant construction and the provision of required tools and other facilities, thereby further extending work opportunities and benefits;
3. Both the foregoing produce tax revenue for Federal, State and local governments from both income and property taxes;
4. They raise the general standard of living by providing improved goods and services in general use.

Certainly, secondary or indirect benefits of the above types are greatly sought by all. They are mentioned after the foregoing only because to some extent they are less directly of concern to the Government than the obtainment of superior weapons, systems and services for direct use by the Government, and the continuous betterment of such items and their ready maintenance on a widely available and reduced cost basis.

REPORT OF THE PRESIDENT'S COMMISSION ON THE PATENT SYSTEM

1966

The Commission on the Patent System was established by President Johnson's Executive Order 11215 in 1965. It dealt almost entirely with the general operation of the patent system. The Commission's report "To Promote the Progress of . . . Useful Arts in an Age of Exploding Technology" was submitted in November 1966. Only one of the Commission's many recommendations dealt with Government Patent policy, and the text of this recommendation is included here.

Government Patent Policy

Recommendation XXXII

The Commission has noted the increasing participation of the Federal Government in the financing of research, development, testing and engineering, and the many problems related to the ownership of patents resulting from such work.

The Commission decided not to address itself to the question of the distribution of rights in inventions resulting from research and development work financed wholly or in part by the Government. This question is being considered actively elsewhere in the Executive Branch and by Committees of the Congress.

Nevertheless, it is the Commission's hope that any action Congress may take in this regard will promote the purposes of the patent system to encourage invention and innovation and the resulting economic development benefits.

GOVERNMENT PATENT POLICY STUDY

(The Harbridge House Report)

1968

The Harbridge House Report deals with the impact of Government Patent policy on several aspects of the National Economy. It was commissioned at the initiative of the Committee on Government Patent Policy of the Federal Council on Science and Technology in September 1966. It's purpose was to obtain in-depth data about the actual effects of the existing Government Patent Policies. The study was performed by Harbridge House, Inc., a research and management consultant firm of Boston, Massachusetts, and the report was submitted in May 1968.

GOVERNMENT PATENT POLICY STUDY

1968

Preface

In October 1963. after 18 months of intensive interagency deliberations, the President issued a Memorandum and Statement of Government Patent Policy. The Policy established, for the first time, basic criteria to guide all executive departments and agencies not otherwise governed by statute in allocating rights to inventions made under government grants and contracts. The Policy was viewed as a first attempt to establish a central rationale for allocating patent rights government-wide in accordance with the public interest.

Because of its newness and the great concern of government and industry over the subject, the President provided for continuing evaluation of the Policy to determine the need for revision. In December 1965, the Federal Council established the Committee on Government Patent Policy, to examine the principles established by the policy and their effect on the public interest. The Committee, comprised of policy level officials from the R&D sponsoring agencies represented on the Federal Council and representatives of the Departments of State and Justice, first identified the basic policy questions underlying the President's Memorandum. It determined that three questions represented the fundamental policy issues:

(i) What effect does patent policy have on industry participation in government R&D programs?

(ii) What effect does patent policy have on the commercial utilization of government-sponsored inventions?

(iii) And what effect does patent policy have on businees competition in commercial markets?

In considering a way to examine the questions, it concluded that a study contract would best collect and analyze the necessary data. In September 1966, the Committee commissioned Harbridge House to study the policy questions and to prepare reports which would: (i) help test the effects of alternative patent policies; (ii) lead to affirmation or revision of the President's Policy or assist in formulating useful legislation; and (iii) be useful to executive departments and agencies in administering government-wide policy, whether established by Congress or the Executive Branch.

The accompanying final report and three research reports describe the study findings. Volume I summarizes findings on the three policy questions. Volume II reports on Question One—the effect of patent policy on industry participation in government research and development programs. Volume III reports on one aspect of Question Two—the efforts of eight federal agencies to promote commercial utilization of government-sponsored inventions. And Volume IV reports on

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Questions Two and Three—the effect of patent policy on utilization of government-sponsored inventions and business competition.

Summary and Analysis of Findings

A. STUDY OBJECTIVES AND APPROACH

The primary purpose of the Harbridge House study has been to provide government policy makers with data to evaluate the effectiveness of government patent policy in achieving policy objectives. The study sought answers to three basic questions which underlie the government's objectives concerning patents arising out of government contracts:

(i) How does patent policy affect commercial utilization of government-sponsored inventions?

(ii) How does patent policy affect business competition in commercial markets?

(iii) How does patent policy affect participation of contractors in the government's research and development programs?

A three-phase study effort was undertaken to answer these questions: In phase one, existing data was gathered to determine what relevant information was already available. Phase two consisted of a utilization questionnaire survey to gather a broad body of new data on a large sample of government-sponsored inventions. And, phase three involved case studies of inventions and contractors in the utilization survey to develop a fuller understanding of the effects of patent policy on them.

The first phase involved four separate tasks. A literature search was conducted to determine what existing data were available on the study questions. In addition, three research tasks were conducted within government activities to (i) determine the promotional programs of eight government agencies; (ii) review reported instances of industry hesitation or refusal to participate in programs of the Department of Interior and the National Institutes of Health (NIH) for reasons relating to patents; and (iii) examine 100 contractor NASA waiver requests to determine the basis for waivers of patent title granted by NASA. These tasks, useful in themselves, also provided background information in conducting phases two and three of the study.

In the second phase of the study, commercial utilization of all government-sponsored inventions patented in 1957 and 1962 [1] were surveyed through questionnaires [2] to gather data on utilization and licensing of a large and statistically significant group of patents. A two-year sample was selected to ensure against bias in patents issued in a given year, and the years 1957 and 1962 were chosen to allow enough time for sample inventions to be applied commercially. Although the sample predates the current policy established by the Kennedy Memorandum of 1963, patent rights in sample inventions were allocated in different ways under various programs making it possible to project the results of the study in terms of current policy.

[1] For government agencies other than DOD, AEC and NASA all patents issued from 1956 to 1966 were included because of the small number of patents issued on inventions of those agencies in 1957 and 1962.

[2] Copies of the questionnaires are included in an appendix to this report.

Questionnaires on each invention were sent to organizations which developed them regardless whether the contractor or the government retained title. Similar questionnaires were also sent to firms which requested licenses to government-owned inventions, whether developed under contracts or in government laboratories, to compare conditions under which inventions might be used with and without exclusive rights. Both included questions on the size and business orientation of the responder; the nature of the invention; the role it played in its commercial use; the speed with which it was applied; the type and amount of private funds invested in applying it; the sales attributable to the invention; the extent to which it was available for and resulted in licenses by patentee; and the reasons for nonutilization where it was not used commercially.

Questionnaire responses were received on about 60 percent of the sample inventions and were analyzed to determine the patterns of utilization, and the effect of patent rights and other factors on commercial use, licensing and business competition. The data were also used to select areas for case research in phase three of this study.

The case research in phase three gathered more detailed data on selected government contractors and inventions to understand better the factors which control decisions to utilize government-sponsored inventions, the utilization process, the effect of utilized inventions on business competition and the factors affecting willingness of contractors to participate in government-sponsored R&D programs. Five groups of case studies were conducted:

(i) Twenty-one high and low utilizers of sample inventions were interviewed to determine the reasons for their performance.

(ii) All sample inventions of TVA, and the Department of Agriculture and Interior were investigated to determine the effect of agency mission on invention utilization.

(iii) Sixteen educational and nonprofit institutions representing a cross section of all types and sizes of organization were interviewed to determine what role they play in promoting utilization of government-sponsored inventions.

(iv) All sample inventions involved in infringement suits were investigated to identify what effect they have on business competition.

(v) An industry study involving the medicinal chemistry program of NIH was performed to determine the effect of patent policy on voluntary industry participation in, and utilization of the results of the government program.

B. EFFECT OF GOVERNMENT PATENT POLICY ON COMMERCIAL UTILIZATION

This study sought answers to several key questions concerning commercial utilization of government-sponsored inventions. Among these were:

(i) Under what circumstances have government inventions been utilized?

(ii) How important have exclusive patent rights been in promoting their use compared with other factors such as market potential, prior experience and amount of private investment required?

(iii) Under what conditions has utilization been optimized by government ownership of patents? By contractor ownership of patents?

(iv) Has substantial private investment been required to develop government-sponsored inventions for commercial use?

(v) Has such investment been made when everyone has been free to use the invention?

Several factors were found to have an important bearing on the answers to these questions. The intended uses of the sample inventions were found to have a primary effect on their commercial potential. Their intended uses, in turn, were determined by the R&D missions of the sponsoring government agencies. Once the invention was developed, several factors were found to affect their actual use in commercial markets—the extent of market demand for products employing them, the degree of promotion by government agencies which sponsored them, the size of private investment required to apply them, the prior experience and attitude toward innovation of organizations that developed them, and the type of patent rights available to protect the user's investment in bringing the inventions to market.

These factors have had the following net affect on utilization of sample inventions:

Of 2,024 contractor inventions in the two sample years for which information was available, 251 were used commercially.

Two hundred were utilized by industrial contractors and all but seven were owned by them. Twenty-six of these were utilized by their licensees.

An additional 51 inventions not utilized by contractors were utilized by their licensees. Ten of these inventions were owned by educational and nonprofit institutions.

Fifty-five played a critical role in the commercial products in which they were used.

All but two resulted from DOD contracts.

The study also reviewed 126 government-owned inventions from all sources, in-house and contractor, patented in 1957 and 1962 for which a license was issued to firms other than the inventing contractor. Ten of 126 inventions were reported used by some 50 licensees. Utilization is concentrated in TVA and Agriculture inventions which account for 60 percent of the utilized patents and 90 percent of the commercial users.

Measured in sales, commercial utilization of the inventions studied amounted to $616 million through calendar year 1966:

$406 million were sales by contractors who owned the inventions

$210 million were sales by nonexclusive government licensees.

All but $271,000 of contractor sales were from DOD inventions.

Sales of inventions, both with and without exclusive rights, were heavily concentrated in a few patents:

88 percent of contractor sales where the invention played a critical role are attributable to five patents in the fields of transistors, vacuum tubes, numerical control devices, computers, and gas turbine engines.

About half the sales of licensees are attributable to three patents on the manufacture of potato flakes.

Study inventions that were used commercially found quick application in their commercial use. About one-third were applied by the time a patent application was filed, and almost two-thirds were in use when a patent issued.

A factor instrumental in the speed of utilization is prior experience. If rapid utilization is defined as occurring within three years of application for a patent, then firms with experience achieved rapid utilization over 80 percent of the time compared with half that for firms without.

The mix of government and commercial work within a firm also has an important effect. Firms in the middle range of government activity (20 to 80 percent government business) use inventions much more quickly than companies predominantly in either the commercial or the government markets.

1. Effect of Agency Mission and Commercial Potential of Sample Inventions on Utilization

The R&D mission of the sponsoring government agency was found to have a critical effect on the commercial applicability of the sample inventions. The Department of Defense, NASA and AEC accounted for some 90 percent of contracted research and more than 98 percent of the patents arising under contract in the years under study. Inventions covered by these patents were designed to meet operating requirements of these agencies rather than civilian needs in the great majority of cases. Their commercial applications, therefore, were essentially a by-product of governmental uses and depended largely on coincidental overlap between government and commercial requirements. Thus, over 70 percent of the reasons advanced by responders as most important to nonutilization of sample inventions relate to their limited commercial potential. This in no way measures their value for their intended use, but simply indicates the effect of differences between operating requirements of the government and civilian needs in commercial markets.

On the other hand, commercial inventions with significant utilization were among the patents of these agencies in the fields of transistors, vacuum tubes, numerical control devices, computers and gas turbine engines, where the necessary commercial overlap did exist.

The sample inventions of other agencies—such as the Department of Agriculture and Interior, and TVA—were highly oriented to civilian requirements reflecting the civilian orientation of their R&D missions. Since most of the Agriculture and TVA R&D programs are conducted in-house, the sample included few inventions developed by their contract programs. However, these were supplemented with in-house inventions for which the agencies granted licenses. All that were used commercially, were used without exclusive patent rights. This was largely attributable to three factors: the commercial orientation of the inventions, good potential demand for their use, and sufficient government development of the inventions to show their commercial feasibility. Notwithstanding the commercial potential of these government inventions, agency promotion within industry was important in achieving utilization of Agriculture and TVA patents because of the need to convince firms of their commercial value. In several instances, utilizing firms acquired some measure of patent protection by developing patentable improvement to the government inventions.

Two causes predominated in cases where the inventions of these agencies did not achieve commercial utilization. Lack of full technical development of the inventions was the most frequent and important. No market need due to the complexity of the invention, its high cost compared with other methods or the availability of more practical alternatives was second in importance. It is probably that some measure of exclusive rights might have encouraged private firms to complete technical development of some inventions not fully developed by the government where adequate demand existed to make them attractive investment opportunities.

The R&D programs of HEW and Interior illustrate still another effect of mission on utilization. The programs of these two agencies are oriented to civilian needs, but in many aspects, are directed toward basic rather than applied research. The sample inventions that have resulted from their work have not, for the most part, been sufficiently developed to prove their commercial value. However, should their inventions reach that stage in programs like water desalination, and medicinal chemistry, broad commercial utilization could reasonably be anticipated because of the strong potential demand for commercial innovations in these fields.

2. Private Development Costs

Information on private development costs required to apply sample inventions commercially was somewhat sketchy due to the age of the sample and the confidential nature of the data. But the information gathered showed significant differences in the types of costs incurred on DOD-oriented inventions (with exclusive rights owned by the contractor/utilizer in almost all cases), and civilian-oriented agency inventions (with nonexclusive licenses owned by the utilizers).

Private investment was heavily concentrated in technical development of DOD inventions. Fifty-six and eight tenths (56.8) percent of private dollars were spent for development compared with 22.7 percent for production facilities and 20.5 percent for marketing the product. In contrast, only 21.1 percent of private investment was required for technical development of civilian-agency inventions, while 52.2 percent was spent on production facilities and 26.7 percent on marketing.

The data confirms the relationships observed above between agency R&D mission and commercial potential of sample inventions. Civilian agency inventions, in general, are closer to commercial products when government development is complete than are DOD inventions. Thus, users of civilian agency inventions assume less financial risks in applying them than users of DOD inventions. This has a bearing on the degree of patent protection that may be needed as an incentive to utilization. All other factors being equal, more protection is required where the technical costs and financial risks are greater than where they are not.

3. Patent Rights as Incentives to Commercial Utilization

The study data show that patent rights play widely different roles in the business affairs of organizations in the sample. The sharpest distinction occurs between educational and nonprofit institutions, on the one hand, who can only achieve utilization of their inventions by

licensing others, and industrial firms, on the other, who can promote utilization through direct use and licensing.

Educational institutions in the past have been much more concerned with publishing the results of their research than with promoting patents that may arise from it. Today, however, schools with large government research programs are taking greater interest in their patent portfolios and are seeking through a variety of means to promote them through licenses with industry. Nonprofit research firms also view their patents as a potentially useful source of income and actively seek to license others. In both cases, the inventions must frequently arise from basic research and require substantial private development before reaching the stage where they are commercially useful. Some measure of exclusive rights appears necessary to motivate licensees to invest in the work necessary to commercialize these inventions. Where the institution has an active promotional program and the government has none, commercial utilization would appear to be promoted more effectively by permitting the institution to retain exclusive rights. Where this is not so, more individual analysis is needed to determine what allocation of rights would best foster utilization.

Industrial firms in the sample place differing weights on the need for exclusive rights in using government inventions. At one extreme were firms who rely heavily on patent rights to establish their proprietary position in commercial markets and would hesitate to invest in an invention in which they could not obtain exclusive rights. At the other, were firms so completely in the government market that they attach little or no importance to patent rights for commercial purposes. In between were firms for whom patents provide a variety of incentives. The nature and importance of these incentives to firms in the sample are outlined below.

A lack of interest in patents was characteristic of some research-oriented and manufacturing firms that do a preponderance of their business in the government aerospace and defense markets. No desire to expand into commercial markets and no mechanism for the commercialization of inventions were noted. When these firms obtain patents, their sole purpose is recognition within the company of technical competence.

In a second group of firms patents were secondary to broad technical and management competence in maintaining their position in commercial markets. Firms expressing this attitude toward patents were generally manufacturers of complex systems and technical products, such as aircrafts, jet engines, computers, or communications equipment. Although as much as 75 percent of their sales may be direct to the government, these firms frequently sell similar products to commercial markets. Inventions developed during the course of R&D activities tend to be auxiliary components and subsystems or incremental improvements to the basic product. These inventions are not as important to these companies in sustaining sales or selling new products as is the basic engineering management and production capability of the firm. New ideas and inventions are incorporated in product modifications or in new models with little consideration given to the protection offered by patent rights. Using a new idea to enhance product performance is regarded as more important than assuring that the company owns the exclusive right to use it.

A third group of firms believe that corporate ownership of patents offers flexibility in design, both in the United States and abroad (through ownership of corresponding foreign patent rights), and provides trading material for cross-licenses with competitive firms. Ownership of a patent, however, as a prerequisite for new product development is a relatively minor factor compared with market considerations and investment requirements associated with commercialization of the invention. A change in government patent policy may affect firms in this category by causing them to choose more carefully the areas in which they are willing to undertake government research. Faced with the possibility of being unable to obtain title to patents they develop, these firms may refuse to contract in research areas that would impair their operational flexibility.

A fourth group of firms actively seek ownership of patents, to establish and maintain proprietary positions in new technologies, as well as in established product areas. Invariably, however, estimates of market potential and corporate investment requirements determine which product areas are developed. The makeup of the patent portfolio may indicate the direction for product development in order to strengthen proprietary positions, but development is rarely, if ever, undertaken solely because patent protection is available. A change in government policy from license rights to title rights would limit the government-sponsored R&D activity of firms in this category because of possible conflict with company-sponsored research activities. Contract opportunities would be examined on an individual basis and, in many cases, the government might be refused.

A fifth group of firms regard patent rights as essential to their business activities, and are careful to avoid government claims or conflicts over ownership of inventions. Their policies generally lead them into one of two business patterns. In the first pattern, firms will assure corporate ownership of patents before initiating work on a government contract. They may assure ownership either by negotiating contracts that permit them to acquire title to patents on inventions they may develop, or by developing and patenting basic inventions with limited private funds and then seeking contract work in order to develop additional technical competence, push the state of the art, explore a new technology, or determine if commercial applications may begin to be drawn off. In these situations, firms deliberately select areas of government research to match their commercial interests in order to generate product ideas with commercial possibilities. New research firms with strong technical abilities and limited capital typically follow this pattern, as do specialized firms that have concentrated their business in a limited area of technology.

In the second pattern, firms consciously isolate government work from their commercial operations and pursue these activities separately. The sample firms in this category did only a small percent of their business with the government and were quite independent of it. Frequently, inventions derived from government contract work by these firms will be assigned automatically to the government to avoid title conflicts or commingling with company-sponsored R&D. In other cases, government R&D will be undertaken only in areas where there is no potential conflict with corporate proprietary objectives and in order to enhance the corporate image. The technical value of

government contracts to the commercial interests of these firms is rarely considered a valuable supplement to in-house research and development.

Many diversified companies follow different patent policies in their commercial and government markets. These firms may place a strong emphasis on maintaining proprietary positions in commercial markets and express a relative lack of interest in patents arising from government work. The primary purpose of securing patents on government-sponsored research discoveries is in the case of the wholly government-oriented firms, is to provide professional recognition for technical personnel.

Lastly, an important difference was observed between the research-oriented firms doing business with DOD, NASA and AEC, and the product-oriented firms whose interests are aligned with Agriculture and TVA. The former were much more aggressive in their search for useful innovations in the work they performed than the latter who tended to rely on the results of government laboratory programs for innovations in their fields. Thus, although the food, textile, and fertilizer industries are less patent-conscious, they are also more conservative in the risks they are willing to take in applying new inventions. This accounts for the frequent need for active government promotion of Agriculture and TVA inventions even when the inventions appear to have clear commercial applications.

4. Effect of Patent Policy

Notwithstanding the varying roles assigned patent rights by the firms described above, the key questions is whether permitting them to retain exclusive rights will, on balance, promote utilization better than acquisition of title by government.

The study data indicate that the answer is yes in at least the following circumstances:

(i) Where the inventions as developed under government contracts are not directly applicable to commercial uses and the inventing contractor has commercial experience in the field of the invention. This occurs most frequently with DOD, NASA and AEC inventions. In the case of DOD, the fact that it does not actively promote commercial use of its patents is an added factor. In these instances the inventing contractor with commercial experience appears to be the logical candidate to attempt utilization either directly or by licensing others; and

(ii) Where the invention is commercially oriented but requires substantial private development to perfect it, applies to a small market, or is in a field occupied by patent sensitive firms and its market potential is not alone sufficient to bring about utilization. Inventions in this category may arise with any agency and may have had only limited government development toward a commercial application.

C. EFFECT OF GOVERNMENT PATENT POLICY ON BUSINESS COMPETITION

To evaluate the effects of government patent policy on business competition, the study tried to answer three questions:

(i) What are the effects on competition of the acquisition of exclusive commercial rights to government-sponsored inventions?

(ii) Do they increase or decrease concentration in commercial industries?

(iii) Do they create or eliminate significant areas of market power?

In evaluating the impact of government patent policy on competition, it is important to distinguish the effects of patent policy from other effects which may result from industry participation in government programs. Competitive advantages in commercial markets may well accrue to government contractors through knowledge gained in new technologies, through sharpening of technical skills, and through government funding of R&D work, which has parallel commercial areas of interest. But these are quite separate from the advantages of owning patents to specific inventions. This study has tried to measure only the latter. And, it has tried to measure it in terms of the inventions included in the survey sample. While a broader study of the cumulative effect of government-sponsored inventions patented over several years might have provided more definitive data, we believe that the study data provides a representative and useful picture of the effects of patent policy on competition.

The study indicates that both in number of inventions utilized and in sales volume, the patents sampled appear to have had small impact on commercial markets. Although over 80 percent of both sample inventions and utilization were concentrated in 50 firms, only 55 inventions owned by contractors—2.7 percent of the sample—played a critical role in their commercial use, and five were responsible for $201 million out of the $406 million in cumulative sales attributable to contractor inventions. This utilization of critical-role contractor-owned inventions is low compared with the total sales of these firms and the industries in which they participate. Of equal importance is the fact that very few instances were reported where owners of govenment-sponsored inventions refused to license their patents. Only 15 inventions—less than 1 percent of the sample—involved such refusals, and these 15 refusals involved just five companies.

The study did show that government retention of title, when coupled with full development and active government promotion of inventions having high commercial potential, has promoted competition. A striking example of this is the fertilizer industry where TVA developed high-concentrate fertilizers, patented them, proved their effectiveness on pilot farms and their commercial feasibility in pilot production, and aggressively promoted their use among farmers and fertilizer manufacturers. Industry sales have increased greatly through the manufacturer of these fertilizers by many small regional producers. In circumstances like these, government retention of title can be an effective spur to competition because licenses are available to all comers. But several additional factors must be present for patent policy to have this effect. It must be evident to licensees that the invention has good commercial potential. The invention must be producible in commercial quantities and marketable at a cost that is competitive with alternative product. And the risks of recoupoing development costs mustbe no greater than similar investment opportunities available to the licensee.

In most cases, government agencies have to go far beyond discovery of an invention to create these conditions. Some agencies do—as described in the Volume III report on government efforts to promote

utilization of government-sponsored inventions. The Department of Agriculture. for example, has an active program of developing inventions to the point of commercial feasibility. Potato flakes and frozen orange juice are two of its well-known successes. That agency, in promoting potato flakes, sponsored pilot production of the product and performed a market study in supermarkets in a major city to determine the product's consumer appeal. The study was then made available to the food industry to stimulate interest in the product.

In other cases, allowing industry to retain title to inventions has promoted competition. The clearest example of this is the small firm which penetrates a market of large competitors on the strength of a patent on a government sponsored inventions. Just such a case is described in Volume IV, Part V, Section C.

Notwithstanding the utilization programs employed by government agencies, none except AEC has an express statutory mission to increase business competition in commercial markets for its own sake. When it does occur, however, it is an indirect result of their efforts to accomplish their basic mission. From our observations of the study inventions and insofar as the effect of patent policy is involved, competition does not appear to have been adversely affected by this lack of direct concern, for three reasons:

(i) The rate of utilization of government inventions has been low.

(ii) The agencies—such as TVA and Agriculture, whose inventions are most likely to be utilized—either developed them in-house or took title to them when developed under contract.

(iii) And industrial owners of government-sponsored inventions have been willing to license them upon request or, where they were unwilling to license, alternative technologies were available to competitors in the great majority of cases.

Based on all observations of the sample inventions we have found little evidence of adverse effects on business competition by permitting contractors to retain title of government-sponsored inventions.

D. EFFECT OF GOVERNMENT PATENT POLICY ON INDUSTRY PARTICIPATION IN GOVERNMENT R&D PROGRAMS

The effect of government patent policy on industry participation in R&D programs was the most difficult factor to measure becsuae of the difficulty of obtaining data on the question. However, a useful understanding of problems in this area was obtained by studying the medicinal chemistry program of the National Institute of Health (HEW) and various contracts of the Department of the Interior. This aspect of the study attempted to answer such questions as:

(i) Do competent business organizations refuse to undertake government R&D work—either entirely or in selected areas—because of government patent policy?

(ii) What effect does policy have on application of a contractor's most advanced private technology to government programs?

(iii) Does patent policy have any influence on the flow of information concerning new developments between a contractor's government and privately sponsored work?

The data available to us only allows us to define some first-order effects of the policy in this area.

Industry's main concern about particpating in government research has been the compromise of private investment in research and invention. Frequent objection was made to the "peephole" effect of government programs, whereby the government receives rights in the accumulated results of private work. The "peephole" effect has its counterpart in patent matters where an invention has been conceived at private expense, but reduced to practice under a government program. The traditional patent provisions classify this as a government invention and dispose of its rights under the terms of the contract.

The reach of the contract has been extended in some program to background patents owned by the contractor at the time of contracting. This practice causes the sharpest industry reaction of all because firms feel caught between their wish to participate in government programs and the need to protect their private investment and competitive position.

The major adverse effects of patent policy on participation are program delay, loss of participants, diversion of private funds from government lines of research, and refusal to use government inventions and research when questions regarding a company's proprietary position are raised. These adverse effects occur selectively, but they have occurred at important points in government programs observed in the study.

The key to the participation questions, however, lies in the attitude of prospective contractors toward the role of patents in their activities. As noted in connection with utilization, patents have varying importance to organizations doing business with the government. Industrial firms whose major business objective is participation in government work and systems-oriented companies in the study sample were at one end of the scale and were found to assign patents a secondary role compared with technical and management competence. Patents typically were used by the former to provide recognition to technical personnel and to project the creative quality of their work to their government customers. Systems firms, on the other hand, were found to rely on patents to ensure design freedom, provide material for cross licensing agreements as well as to recognize creativity in their technical personnel. The data indicates that firms in these two categories are not likely to refuse to participate in government R&D for patent reasons. However, systems firms may encounter participation problems at the subcontract level if the government acquires title to all inventions developed under its program.

On the other hand, firms which place a high value on patents for defensive purposes tend to choose among the areas in which they are willing to undertake government research and may decline to participate in programs which impair their operational flexibility. And, firms in research-intensive industries like electronics and new technically-oriented firms seeking to develop a proprietary product-line through government research were found to rely on patents to establish proprietary positions. These firms tend to be selective in their government-sponsored research and may decline to participate in programs which conflict with their privately sponsored research and development or which do not promote their growth objectives for proprietary lines.

Firms which follow this policy even more fully try to assure corporate ownership of patents before initiating work on a govern-

ment contract or may consciously isolate government work from their commercial operations. In the latter case, there is usually little interchange of technical innovations between the government and commercial activities of the firm and there may be some loss of relevant technical experience and applications to the government work.

Lastly, large diversified firms often follow different patent policies in different divisions of the organization. Accordingly, they may be willing to participate in government programs with small concern for patents in some areas but with great concern for patent rights in others. It is difficult to generalize about these firms except to notice that their policies tend to follow the patterns of the industries in which their divisions participate. Their behavior may, therefore, resemble any of the categories of firms described above if their divisions have similar business profiles.

With respect to educational and nonprofit institutions refusal to participate for patent reasons is not normally a problem. However, instances were found in Department of Interior programs where patent problems were encountered because of conflicting institutional obligations arising from joint support of a research program or where rights in background patents were sought as a condition of the project. With the rising interest in nonprofit institutions in patents as a source of revenue, greater concern over patent rights can be expected from institutions with large research programs as financial pressures on these organizations continue to increase.

Viewing the participation problem from the standpoint of individual government agencies, the effect of patent policy varies with the nature of their R&D programs and the contractors that participate in them. Participation problems are not a concern to TVA which performs virtually all its research and development itself and, therefore, has little or no contractual interface with industry. They are also minimal in Agriculture programs since that agency contracts almost all its extramural research and development with educational and nonprofit institutions. In addition, the firms that do participate in its programs do relatively little research and development on their own and tend to be less patent conscious than those participating in defense/aerospace work.

The direct effect of policy on NSF and HEW programs also appears to be small because most of their contract research is either basic in nature, offering limited opportunities to develop patentable inventions, or is performed by nonprofit institutions who, for the most part, are interested in the research for itself. However, some problems may be encountered in instances of joint or overlapping research at nonprofit institutions where the rights of other parties may be involved. And, a significant indirect effect has been noted in an important HEW health program where voluntary noncontractual participation by a patent sensitive industry was curtailed because of patent considerations.

The Department of Interior, like HEW and NSF, has a number of programs—such as water desalination—which are oriented toward developing basic technologies. The Agency contracts in these areas with research-oriented industrial firms (many of whom are patent conscious), as well as educational and nonprofit institutions, and acquires title to patents arising under its programs. Under some programs, statutes on which they are based have been interpreted to

require the agency to acquire rights in existing patents owned by contractors because of their relevance to the contract effort and future utilization of contract results. These factors—patent conscious organizations and acquisition of rights to contract inventions and existing patents—have resulted in several instances of hesitation or refusal to participate in the government program. Insufficient data was available to establish how widespread the reaction was or its overall effect on Interior programs.

The largest number of opportunities for participation problems occur, of course, in DOD, NASA, and AEC programs because of the size and scope of their contract effort. Only a limited amount of data was available on this question for these agencies but a few general observations may be made. At least as to the majority of DOD inventions, to which contractors are normally permitted to retain title, no problem arises. In addition, NASA's policy of waiving title to inventions to promote utilization under appropriate circumstances provides a method for resolving competing government and indsutry objectives with regard to patents arising under contract. Lastly, interviews with industrial firms in the survey sample indicate that—except where a large investment in private research, know-how, inventions and/or patents considered to be valuable in commercial markets exist—acquisition or improvement of technical skills is sufficiently important to them in most cases to justify participating in government programs in their areas of interest even though patent provisions are not completely suitable to them.

However, this does not mean that either a title or license policy will equally serve the government's interests under all the above circumstances, since the policy selected may also affect industrial decisions to use contract inventions commercially. Here again, a balancing of government objectives appears necessary to ensure that the net effect of the patent policy promotes the government's overall goals.

Part I. The Study Task

The goal of the Harbridge House study has been to determine the effects of government patent policy on the objectives it is designed to achieve. Essentially, these objectives are three:

(i) Encourage participation in government research and development programs;

(ii) Promote commercial utilization of government-sponsored inventions; and

(iii) Foster business competition.

While it is easy to agree on the policy objectives, it is hard to agree on how best to achieve them. Lack of information on the economic effects of the policy has been a major obstacle in this respect. There have been no ready answers to such questions as:

(i) Is commercial utilization of government inventions achieved best under government or contractor ownership?

(ii) Is substantial investment over and above that supplied by the government necessary to achieve utilization: If yes, are exclusive rights necessary or useful in attracting private capital capital for further development, or will such investment be made when everyone is free to use the invention?

(iii) Do competent firms refuse to undertake government R&D work because of government patent policy? Does the policy affect application of the contractor's most advanced privately developed technology to government projects? Does it affect assignments of personnel to government contracts? And, does it affect the flow of information between the contractor's government and privately sponsored work?

(iv) What are the effects on competition of the acquisition of exclusive commercial rights to government-sponsored inventions? Do they increase or decrease concentration in commercial industries; cement or dilute positions of leadership in industry; create or eliminate significant areas of market power?

A major objective of the study has been to acquire and analyze information which would help answer these questions. As described in the Summary and Analysis of Findings the study was accomplished in three phases and the data were gathered through several related tasks, which were researched for 18 months within government, industry, and educational and nonprofit institutions. Since the research data are a significant source of new information on the role of patents within government, industry, and nonprofit institutions, they are reported in some detail in the research reports which comprise Volumes II, III, and IV of the final report. Names of organizations and other information received in confidence are disguised throughout the study.

Part II. The Policy Criteria and the Sources of Government Invention

The President's statement of policy [1] establishes several criteria for allocating patent rights between the government and its contractors. The criteria tend to align with the R&D programs of specific agencies, resulting in relationships among R&D programs, inventive output and patent rights which help explain the economic effects of government patent policy.

Section 1(a) of the policy provides for the government to retain principal rights when:

(i) The end item is intended for commercial use by the general public or government regulations will require it for public use [Section 1(a)(1)].

(ii) The principal purpose of the contract is to explore fields concerned with public health or welfare [Section 1(a)(2)].

(iii) The contract pertains to new fields of science and technology in which the government has been the sole or principal developer, and the acquisition of title by a contractor might give him a dominant or preferred commercial position [Section 1(a)(3)].

(iv) The contract requires the operation of a government research or production facility or the coordination and direction of the work of others [Section 1(a)(4)].

Section 1(b) provides for principal rights to the contractor when the purpose of the contract is to "build upon existing knowledge or technology" to develop end items for use by the government, and

[1] The President's Memorandum and Statement of Government Patent Policy is set forth in full in Appendix A.

"the contractor has technical competence directly related to an area in which he has an established nongovernmental commercial position." The party that does not receive principal rights normally receives a royalty-free license to use the invention.

Table 1 relates the policy criteria to the agencies whose programs broadly match them. The agencies are grouped into three categories, depending on the main objectives of their programs: (i) public-service agencies, who conduct R&D programs to benefit the public directly; (ii) mission-oriented agencies, who conduct R&D programs for the agencies' own internal use; and (iii) agencies with mixed activities, who conduct both public-service and internally oriented R&D programs.

The contracts of the public-service agencies (like Agriculture, Interior and HEW) if not governed by statute fall largely under Section 1(a)(1) and 1(a)(2) with title in the government, because of their civilian-orientation.

The contracts of DOD, a mission-oriented agency, are interpreted to fall largely within Section 1(b), with title in the contractor because they are not civilian-oriented and they draw heavily on the existing technical competence of industry. To a lesser extent they also come within Sections 1(a)(2), (3) and (4) with title in the government when inventions are in fields concerned with public health or welfare, DOD is the sole or principal developer in the field, or the contractor operates a government facility or directs the work of others. Lastly, the inventions of agencies with mixed activities (such as FAA, AEC, and NASA) may fall under any criteria depending on the purpose of the specific project and the circumstances under which the invention is made.[2] Generally, inventions arising out of public service activities—such as AEC's research on power sources for an artificial heart—would fall within Sections 1(a)(1) and (2). And, inventions from mission activities would come within one of the other three criteria.

Structural differences within the research and development program have a major effect on the number of inventions produced under the various policy criteria. Patents arising out of government contracts are heavily concentrated in the mission-oriented and mixed-activity agencies. There are several reasons for this. Since they perform most of the R&D contracting—91.1 percent in fiscal 1965 (see Table 1)—these agencies provide a far greater number of opportunities for inventions than public-service agencies. In addition, they contract predominantly with profit-making organizations[3]—over 87 percent in fiscal 1965 (see Table 2)—who attach greater importance to patents than educational and nonprofit institutions, the other major participants in federal R&D programs. And a great portion of their funds are spent in applied research and development, which is a greater source of patentable inventions than tasks in basic research.

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[2] Here again, statutory patent policies exist and govern NASA and AEC. Both those agencies are matched with the President's Policy to evaluate its probable effect on them.

[3] Industrial firms and educational and nonprofit institutions as sources of government-sponsored inventions are described in detail in Volume IV, Part I. The importance of patents and government-sponsored inventions to these organizations and their utilization of them are discussed at length in Volume IV, Parts II, III, and IV.

TABLE 1.—CONCENTRATION OF R. & D. FUNDS (1965) IN RELATION TO AGENCY AND GOVERNING POLICY CRITERIA AND PATENTS ISSUED (1957, 1962, 1965)

[Dollars in millions]

Policy criteria	Agencies	R. & D. obligations Fiscal year 1965		Patents issued: contract work					
				1957		1962		1965	
		Extramural	Intramural	Title	License	Title	License	Title	License
I. Principal rights in government:	A. Public service:								
1(a)(1)—End item intended for commercial use by general public.	Agriculture	$61.7	$155.7	0	0	1	1	2	0
	Interior	38.5	84.4	1	0	1	0	0	0
	HEW	682.7	174.8	2	1	4	2	3	0
1(a)(2)—Purpose of contract to explore fields concerned with public health or welfare.	VA	.8	36.9	0	0	0	0	1	0
	TVA	.3	5.5	0	0	0	0	0	0
	NSF	183.2	14.5	0	0	0	0	0	1
		967.2 (9%)	471.8 (16%)	3	1	6	3	6	1
1(a)(3)—Contract pertains to new fields with government as sole or principal developer.	B. Public service and mission-oriented: Commerce	$19.4	$48.5	8	2	7	0	0	0
	FAA	41.7	34.5	0	0	0	8	1	2
	NASA	3,999.9	871.0	0	4	4	7	19	4
1(a)(4)—Contract requires operation of government research or production facility or coordination and direction of work of others.	AEC	1,233.6	32.8	266	[1] 33	289	[1] 98	250	[1] 65
	[1(a)(1), (2) and 1(b) also applicable]	5,294.6 (48%)	986.8 (33%)	274	39	300	113	270	71
II. Principal rights in contractor:	C. Mission-oriented:								
1(b)—Contract builds upon existing knowledge and contractor has technical competence and established nongovernmental commercial position.	DOD	$4,805.6 (43%)	$1,542.9 (51%)	206	958	221	1,501	407	NA
	[1(a)(2), (3) and (4) also applicable].								

[1] AEC rights in these inventions vary. In some it holds a nonexclusive license only. In others it holds a general license with exclusive rights in field of atomic energy.

Source: Annual Report on Government Patent Policy, Federal Council for Science and Technology, June 1966, and study data.

TABLE 2.—ALLOCATIONS OF DOMESTIC R. & D. OBLIGATIONS AMONG PROFITMAKING, EDUCATIONAL, AND NONPROFIT ORGANIZATIONS FOR FISCAL YEAR 1965

[Dollar amounts in millions]

R. & D. obligations	A. Public-service agencies								B. Public service and mission-oriented				C. Mission-oriented, DOD
	Agriculture	Interior	Commerce	HEW	VA	TVA	NSF	Total (percent)	FAA	AEC	NASA	Total (percent)	
1. Profitmaking organizations	$2.2	$13.5	$13.3	$27.1	$0.2	0	$27.4	$83.7 (8.5)	$39.4	$743.3	$3,766.2	$4,548.9 (86.0)	$4,274.5 (89.0)
2. Educational institutions	57.2	10.7	4.3	475.7	.4	$0.3	130.9	679.5 (68.9)	.8	402.9	208.4	612.1 (11.9)	326.9 (6.8)
3. Other nonprofit organizations	2.3	2.4	1.8	153.5	.2	0	24.8	185.0 (18.8)	1.5	87.2	17.4	106.1 (2.0)	203.9 (4.2)
4. Other	0	11.9	0	26.4	0	0	.1	38.4 (3.8)	0	.2	7.9	8.1 (.1)	.3 (0)
Total	61.7	38.5	19.4	682.7	.8	.3	183.2	986.6 (100.0)	41.7	1,233.6	3,999.9	5,275.2 (100.0)	4,805.6 (100.0)

Public-service agencies, on the other hand, have had few patents from R&D contracts (see Table 1) because their contract programs are small, more oriented toward basic research, and conducted predominantly with educational and nonprofit institutions. In fiscal 1965, they obligated $986.6 million for extramural work, or 8.9 percent of the total obligated for work outside of government agencies (see Table 1), and $864 million—87.7 percent (see Table 2)—was spent with educational and nonprofit institutions. Specific agencies exceeded that mark, with over 99 percent of Agriculture's, all of TVA's, and more than 92 percent of HEW's share obligated with those institutions.

The net result of these operational patterns is that the Section 1(a) "government title" criteria will apply to very few government-sponsored inventions, while the Section 1(b) "government license" criteria will apply to the great majority. The contract inventions of the mission-oriented and mixed-activity agencies come largely from applied research in the industrial sector, while those of public-service agencies come from basic research at educational and nonprofit institutions. And the great majority of government-sponsored contract inventions come from military-oriented programs of the Department of Defense which bear little relation to consumer uses.

Part III. Effect of Patent Policy on Commercial Utilization

A. THE UTILIZATION SURVEY

The effect of patent policy on commercial utilization was studied through a survey of government-sponsored inventions reported in Volume IV.[1] The histories of some 2,100 inventions were examined to determine the role of patent policy in their use.[2]

In addition, other factors that affect utilization—such as prior experience, size of firm, mix of government and commercial work, government promotion of inventions, and amount of private investment required to ready inventions for market—were analyzed to estimate the importance of government patent policy as a business incentive.

Interviews and case studies were conducted of contractors and licensees, the two major users of government-sponsored inventions

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[1] Invention utilization questionnaires were sent to contractors who made government-sponsored inventions patented in 1957 and 1962, and for agencies other than DOD and AEC—patented from 1956 to 1966. Questionnaires were also sent to organizations that received licenses of government-owned inventions they did not develop. These inventions included a group developed by government employees. NASA inventions were not included in the survey to avoid duplicating a recent report on that agency, but the findings of that report have been considered in preparing this study.

[2] When the questionnaire responses had been analyzed (see Volume IV, Part I), four additional tasks were performed to complete the information on the sample:

(i) A group of invention utilizers, deemed high and low (which rationale is set forth in Part II of Volume IV, with the results of the task), were interviewed to determine what business factors have the greatest effect on utilization.

(ii) The inventions of three public-service oriented agencies—Agriculture, Interior, and TVA—were researched to determine what effect agency mission has on utilization. The results of this task are reported in Part III of Volume IV.

(iii) A representative group of educational nonprofit institutions were interviewed to determine what role they play in utilization. The results of this task are reported in Part IV of Volume IV.

(iv) All firms reporting refusals to license sample inventions were interviewed and all inventions involved in infringement suits were investigated to determine the effect of patent policy on business competition. The results of this task are reported in Part V of Volume IV.

Responses were received on about 65 percent of the approximately 4,000 questionnaires sent to organization in the utilization survey.

to determine the reasons for basic differences in their patterns of utilization: except for two inventions, utilization with title occurred entirely among contractors of the Department of Defense, while utilization under license occurred almost entirely among licensees of the AEC and the public-service agencies.

The role of educational and nonprofit institutions in utilization was a third aspect of the survey. Inventors of more than 10 percent of the inventions studied, these institutions participate in the R&D programs of almost all government agencies. While they do not use these inventions directly because their activities are essentially noncommercial, they do license them for use by others. The survey was concerned with the effect of their licensing activities on utilization.[3] Findings on these three groups of users are summarized below and reported at length in Volume IV, Parts II, III, and IV.

B. EXTENT OF COMMERCIAL UTILIZATION

The survey showed that commercial utilization of government-sponsored inventions is very low. Contractors and licensees reported only 251, or 12.4 percent, of all inventions in the survey response in use. Only 55, or 2.7 percent, played a critical role in the commercial products in which they were used, as compared to utilization rates of 50 percent or more estimated for inventions developed under private research. Measured in sales, utilization amounted to $616 million through 1966—$406 million of which was attributable to contractors and $210 million to licensees.

1. Contractor Sales and Development Costs

Table 3 shows the sales and private development costs associated with the 200 inventions used by contractors. Of the 200, DOD sponsored 198, to credit it with the major impact on utilization. Of the $406 million in sales, all but $271,000 are also attributable to DOD inventions.

[3] This task is reported in full in Volume IV, Part IV.

TABLE 3.—SALES AND DEVELOPMENT COSTS ASSOCIATED WITH COMMERCIAL UTILIZATION OF INVENTIONS BY CONTRACTORS (1957 AND 1962)

[Dollar amounts in millions]

	Amount [1] of actual domestic sales from—		Amount [1] of actual foreign sales from—		Development costs—				Number of licenses in use for inventions with—	
	Critically important inventions	Inventions with a supporting role	Critically important inventions	Inventions with a supporting role	Amount [1]	Average [2] percent in technical development	Average [2] percent in production facilities	Average [2] percent in marketing	Critical role	Supporting role
Total sample	$193.63	$117.07	$47.28	$47.65	$26.33	56.8	22.7	20.5	31	40
DOD	193.48	117.05	47.18	47.65	25.88	56.8	21.9	21.3	29	38
AEC	0	.021	0	0	.201	52.5	45.0	2.5	1	2
Other agencies	.15	0	.10	0	.25	70.0	20.0	10.0	1	0
1957 DOD	100.85	103.37	45.80	40.32	3.59	58.3	20.0	21.7	12	13
1962 DOD	92.63	13.68	1.38	7.33	22.29	56.2	22.7	21.1	17	25

[1] To date of response to questionnaire.
[2] Average for those responding to this question only.

Sales of critically important contractor inventions are a little over half the total—$193.6 million from domestic sales and $47.3 million from sales abroad; $241 million in all.[4] *Five inventions*, accounting for approximately *88 percent* of the sales in the group, involve the following technologies: *transistors, vacuum tubes, numerical control devices, computers, and gas turbine engines.* The remaining 44 critically important contractor inventions totaled only $29 million in sales. This amounts to annual[5] sales of $20 million for the five inventions with high sales and about $659,090 for the other inventions in that class.

In relating sales to the concentration of patent holdings, it was found that not one of the top ten patent owners has a sample invention with cumulative sales of more than $2 million, even though the group holds 52 percent of all the patents. Only one firm, ranked in the 11 to 25 group, had a patent with significant utilization—$70 million to the date of the survey.

When private development costs were compared with utilization, it was found that firms spent at least $26 million in bringing the inventions into commercial use. It is difficult to generalize on these data because many firms provided no information. However, the data available does indicate that about 56 percent of private funds were spent in technical development and the balance was divided about equally between production facilities and marketing.

2. Licensee Sales and Development Costs

Table 4 shows comparable sales and development costs associated with licensed government-owned inventions. The government issued 342 licenses on 126 survey inventions, ten of which were used by 50 licensees.[6] These inventions are concentrated in agencies other than the Department of Defense.[7] The AEC and the Department of Agriculture account for the largest number, owning 65 percent of these patents and issuing 55 percent of the licenses.

TABLE 4.—SALES AND PRIVATE DEVELOPMENT COSTS ASSOCIATED WITH COMMERCIAL UTILIZATION OF GOVERNMENT-OWNED PATENTS BY NONINVENTOR LICENSEES

[Dollar amounts in millions]

	Amount[1] of actual domestic sales from—		Amount[1] of actual foreign sales from—		Development costs[2]			
	Critically important inventions	Inventions with a supporting role	Critically important inventions	Inventions with a supporting role	Amount[1]	Average percent in technical development	Average percent in production facilities	Average percent in marketing
Total sample	$201.12	$6.945	$2.2	$0.085	$5.389	21.1	52.2	26.7
DOD	.02	.055	0	0	.040	70.0	30.0	0
AEC	.40	0	0	0	.020	50.0	25.0	25.0
Agriculture	196.5	.025	2.2	.085	3.118	17.1	47.9	35.0
TVA	4.20	5.34	0	0	2.211	16.9	58.9	24.2
Other agencies	0	1.525	0	0	0	0	0	0

[1] To date of response to questionnaire.
[2] Average for those responding to this question only.

[4] In grouping the data, sales involving critically important inventions (those which were clearly responsible for commercial sales) were separated from those involving supporting inventions which played an incidental role in sales of commercial products.

[5] Computed from the date of patent application to the date of the survey. Three years were allowed for filing an application prior to issuance of patent. On this basis, the availability of 1957 inventions is 13 years; and of 1962 inventions, eight years. The average availability is 10.5 years for inventions in both sample years.

[6] Since it is common knowledge that government-owned inventions may be used without a formal license, it is probable that more inventions are being used than are noted in government records, although no data were available as to the exact number.

[7] DOD owns only 19 percent of the inventions and issued only 9 percent of the licenses.

Domestic and foreign sales to the date of the survey were $210.3 million, compared to $405 million for contractor inventions. All but $7.03 million of this is attributable to inventions which play a critical role in their commercial use.

Unlike contractor inventions where sales related primarily to DOD inventions, DOD-related sales here account for only .4 percent (75,000) of the total. Agriculture and TVA are the largest contributors of commercial inventions, and, here again, the extreme variability in commercial potential of government patents, seen first in connection with contractor inventions, is evident. Three patents involved in the manufacture of potato flakes account for about half the sales from Agriculture inventions.

As with contractor inventions, reports on private development costs were sketchy. Licensees reported $5.389 million in development expense, with a much smaller share—21.1 percent—going toward technical development of the invention and a much larger share—52.2 percent—going toward production facilities than was the case with contractor inventions. The shift in emphasis, we believe, is because the public service agencies sponsor inventions with greater commercial orientation and, in addition, carry development of their inventions further toward a commercially useful form. Table 4 shows the high percentage of costs going to technical development for DOD and AEC inventions (matching the pattern of contractor inventions in Table 3) as compared to the costs for Agriculture and TVA patents.

3. Utilization of Inventions from the Institutional Environment

Commercialization of institutional patents is increasingly contemplated by private and public institutions of higher education, in need of funds as educational costs outrun traditional sources of revenue. Patent activity in nonprofit research corporations has also been increasing, as a means of financing independent research and development programs.

The rise of interest in patents among nonprofit institutions has been fanned by reports in the press and popular periodicals about the "gold mine" of patentable research findings. Scarcely a month goes by without a report or a feature article on a cigarette filter and Columbia University, ammoniated dentifrice at Indiana University, Wisconsin's vitamins, or a super-juice called "Gator Ade" at the University of Florida. These reports are invariably sprinkled with seven-digit royalty income figures—$14 million from Vitamin D at Wisconsin, $7 million from streptomycin at Rutgers, and so on. Finally, there are allusions to the profit potential in the ocean outside of the Scripps Institute of Oceanography, in the sky above the California Institute of Technology, and in the black boxes of M.I.T.

The facts, however, do not support the thesis that the average nonprofit research organization can expect to realize any substantial income from patent royalties. The liberal arts college in Volume IV, Part IV, Case 10, which has enjoyed an unexpected and large return on a pre-World War II invention, acknowledges it as a windfall and deemphasizes patents accordingly. The technical institution in Volume IV, Part IV, Case 5, one of the five organizations interviewed that actually receives annual royalty income of six figures, still regards patent administration as marginal from a purely financial point of view. The average net annual royalty income of the three institutions

of higher learning with the most active programs in the study was $100,000. Several institutions were currently enjoying higher incomes attributable to a single invention or the settlement of a law suit, but in no case did royalty income approach that of an industrial scale.

As reported by *The Patent, Trademark and Copyright Journal*,[8] the average annual gain for each utilized patent is about $70,000. This figure seems high to us, since our study revealed that firms frequently overstate the value of a patent by equating revenue accruing from the invention with end-product sales. In addition, the figure of $70,000 does not resemble the return on inventions to nonprofit institutions.

Overall, only 10 percent of the survey inventions from nonprofit institutions reached commercial utilization. One of the patent development firms interviewed in our study estimates that 10 to 15 percent of the disclosures it receives result in patents three to four years after submission; 25 percent of these patents are eventually licensed, with 3 percent profitable. As for dollar value, once every three years a university invention is likely to result in an annual royalty of $50,000 or more.

Expectation of large returns, which appears to be a principal motivation behind the upsurge in patent interest among nonprofit organizations, is not likely to be fulfilled for many of them. At best, a well-organized patent program, using the personnel required to meet reporting commitments under government contracts, may expect to reap a modest return for a nonprofit organization.

C. CONCENTRATION OF PATENT HOLDINGS AND UTILIZATIONS

1. Contractor-Owned Inventions

Both utilization and patent holdings of survey inventions are heavily concentrated in a few firms. Table 5 shows the levels of concentration among the top 50 responders. Consistent with the concentration of R&D funds in industry generally, the top five hold rights in 31.2 percent of the inventions and account for 27.2 percent of the inventions utilized. The top 25 hold 70.7 percent of the inventions and 67.6 percent of the utilizations.

Concentration slows markedly with the next 25 firms, the top 50 holding rights in 82.9 percent of the inventions and achieving 81 percent of the utilizations. Although the overall rate of utilization is 10.4 percent, the record of the top 50 firms is consistently below that mark. Only 65 of 192 responders reported any commercial utilization at all.

2. Invention Holdings and Utilization by Firm and Percent Government Business

Table 6A shows the percent distribution of holdings and utilization of sample patents by size of firm and percent government business. Both patent rights and utilization of inventions are heavily concentrated in large companies. Firms with annual sales over $200 million account for about 37 percent of the responders but hold rights (title and license) in 80 percent of the inventions and account for 72 percent

[8] "The Economic Impact of Patents," 2:340–362, 1958.

of the utilization. Table 6A indicates that these same firms (annual sales over $200 million) have the following characteristics:

(i) Firms in the 0 to 20 percent government business category include 20 percent of the responders, have title in 33.9 percent of the inventions, and account for 10 percent of the inventions utilized;

(ii) Firms in the 20 to 50 percent government business category comprise 5 percent of the responders, have title in 19.8 percent of the inventions, and account for 27.5 percent of the inventions utilized;

(iii) Firms in the 50 to 80 percent category include 2.5 percent of the responders, have title in 8.4 percent of the inventions, and account for 12.5 percent of the inventions utilized; and

(iv) Firms in the 80 to 100 percent government business category make up 8 percent of the responders, have title in 17.6 percent of the inventions, and account for 13.5 percent of the inventions utilized.

Highlighting the record of this group of firms with sales over $200 million is the heavy concentration—20 percent of all responders—of firms doing 20 percent or less of their business with the government. These firms own a larger share of inventions (33.9 percent) than they have utilized (19 percent). In contrast, large firms in the 20 to 50 percent category constitute a much smaller percentage of the responders (5 percent) but proportionately own (19.8 percent) and use (27.5 percent) many more inventions than any other class of firms in the sample. Large firms doing 80 to 100 percent of their business with the government comprised only 8 percent of the responders, but they owned (17.6 percent) and used (13.5 percent) a larger share of inventions than their share of responses.

TABLE 5.—CONCENTRATION OF CONTRACTOR PATENT HOLDINGS IN THE SAMPLE, RESPONSIBLE RATE, AND RATE OF COMMERCIAL UTILIZATION: ALL AGENCIES BOTH SAMPLE YEARS [1]

Number of firms	Number of patents in—			Percent [5] of total patents in—			Percent average utilization [6]
	Sample [2]	Response [3]	CU [4]	Sample	Response	CU	
Top—5 [7]	721	662	57	31.2	32.6	27.2	8.6
10	1,150	1,047	92	49.7	51.6	43.8	8.8
25	1,635	1,479	142	70.7	73.0	67.6	9.6
50	1,919	1,735	170	82.9	85.6	81.0	9.8
Total	2,316	2,024	210	100.0	100.0	100.0	10.4
In Sample, no response	1,082						

[1] Total sample includes all patents developed by contractors and issued in 1957 and 1962, except those developed under NASA contracts and 415 AEC inventions.
[2] "Sample" means the total population of patents as defined in footnote 1.
[3] "Response" indicates the number of patents for which questionnaires were returned.
[4] "CU" indicates that commercial utilization has been achieved for this patent, by the inventing contractor.
[5] Percent in each case is the percent of the total patents of responding firms in the sample, the response, and in commercial utilization. For example, a total of 210 patents in CU and the top 5 firms held 57 or 27.2 percent of these patents in CU.
[6] Calculated by taking the sum of patents in CU over the sum of patents in the response for each size class.
[7] Ranking is by order of number of questionnaires in the response.

Note: Number of firms:

(1) Responding	192
(2) Not Responding	271
(3) Total	463
(4) With at least one CU	65

Grouping firms by percent government business rather than by size, Table 6A shows that firms with 20 percent or less in government work have the most patent activity but not the most utilizations. Comprising 43.5 percent of the responders, this group owns 38.9 percent of the inventions and accounts for 29.0 percent of the utilization. Firms in the 80 to 100 percent category are second in level of activity, comprising 31.5 percent of the responders, 26.4 percent of the titles, and 21 percent of the utilization. Firms in the 20 to 50 category, however, show a better record of utilization than any other group. Constituting 23.6 percent of the inventions, they account for 32 percent of the utilization. The high utilization is due primarily to the large firms (over $200 million) in the group. Firms in the 50 to 80 percent category show fairly low levels of activity; comprising 11 percent of the responders, they own 12 percent of the patents and account for 18 percent of the utilization.

3. Government-Owned Inventions

Concentration of license holdings and utilization of government-owned inventions presents a very different picture from contractor inventions. As Table 6B shows, holdings and utilization are very heavily concentrated in small firms with less than $5 million in sales who do 20 percent or less of their business with the government. These firms account for 68 percent of the utilization of government-owned patents. Large firms with over $200 million in sales utilized almost no inventions they did not develop except for a small segment doing 20 percent or less of their business with the government. Thus the pattern of holdings and utilization is exactly the reverse of the pattern or contractor inventions.

Significantly, utilization of licenses is concentrated among inventions developed by TVA and Agriculture, as shown in Table 7. These agencies account for 45 of the 50 users among licensees and six of the 10 utilized inventions. The R&D programs of these agencies are heavily oriented to civilian needs, and they normally develop their inventions fully for consumer use and actively promote utilization by manufacturers and the ultimate consumer.[9] This combination of

[9] Volume III describes the promotional programs of Agriculture, TVA, and six other agencies.

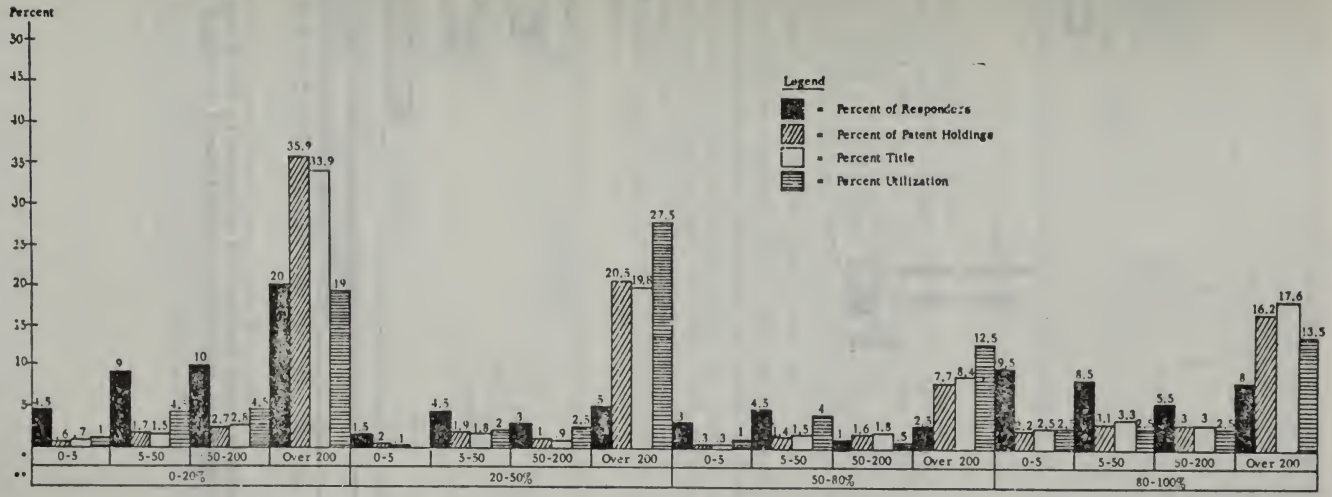

TABLE 6A.—Percent of responders, holdings, and utilization of patents by size of firm and percent government business

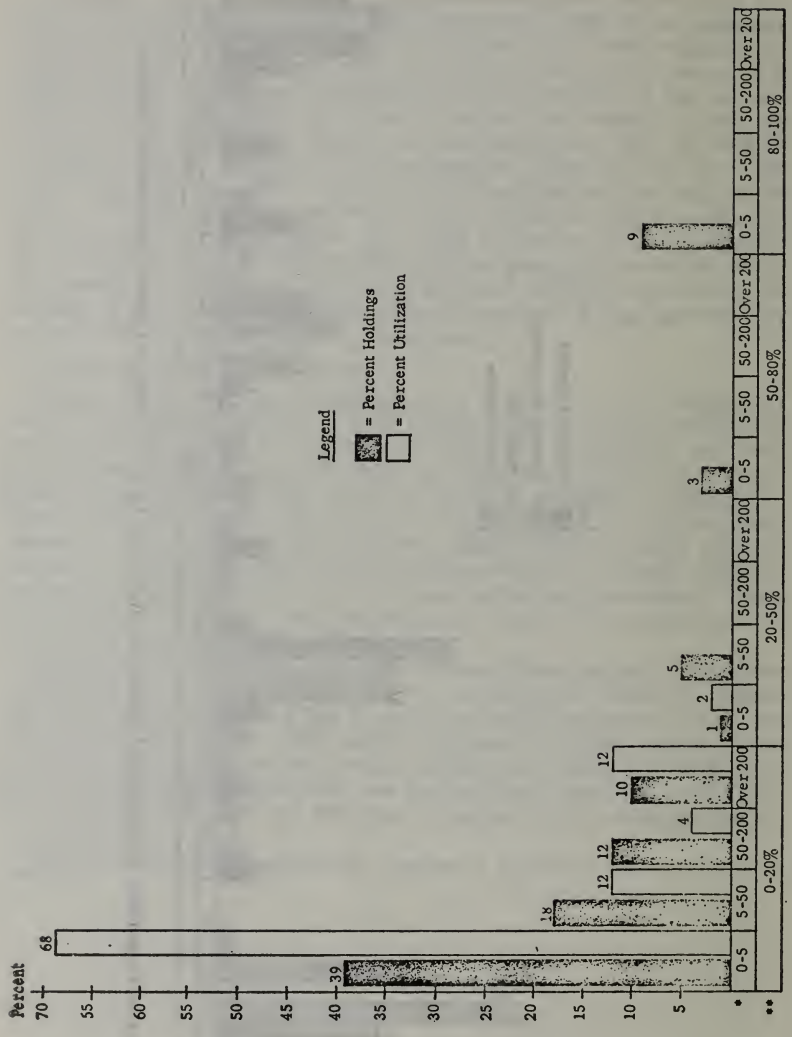

TABLE 6B.—Percent of license holdings and utilization by size of firm and percent government business for government-owned inventions

TABLE 7.—NUMBER OF USES PER GOVERNMENT-OWNED INVENTION

	Total	DOD	AEC	TVA	Agriculture	Other
Inventions in use	10	2	1	2	4	1
Number of users	50	2	2	36	9	1
Number of inventions used:						
Most frequent use	1 at 32			1 at 32		
2d most frequent use	1 at 3					
3d most frequent use	1 at 2		1 at 2		1 at 3	
Once	7 at 1	2 at 1		1 at 1	3 at 1	1 at 1
Number not specified by invention	6			3	3	

factors is largely responsible for their high record of utilization while retaining title.

D. FACTORS AFFECTING UTILIZATION

1. Contractor-Owned Inventions

With the patterns of patent activity in the survey identified, the data were analyzed as to the major factors affecting utilization. Contractor rights, prior experience, percent government business, size of firm, field of technology, form of invention, kind of agency, and year of patents were all tested for their effect on commercial use.

a. Patent Rights, Prior Experience, and Year of Patent.

Of all the factors, patent rights and prior experience show the strongest association with commercial utilization. Table 8 correlates these factors and the year of patent with the rate of utilization. The year of the patent issue appears to have little effect on utilization, but utilization drops from 23.8 to 13.3 percent when exclusive rights are not available [10] and from 23.8 to 6.6 percent when prior experience is not present.

TABLE 8.—CORRELATION OF PATENT RIGHTS, PRIOR EXPERIENCE, YEAR OF PATENT, AND COMMERCIAL UTILIZATION

Characteristics of invention	Rate of commercial utilization (percent) [1]	Observations number utilized	Total number of observations
Year of patent:			
1. 1962 patent, contractor has title and prior experience	22.8	78	341
2. 1957 patent, contractor has title and prior experience	25.6	50	195
Title (both years):			
1. Contractor has title and prior experience	23.8	128	536
2. Contractor has no title, but has prior experience	13.3	8	60
Prior Experience (both years):			
1. Contractor has prior experience, but no title	13.3	8	60
2. Contractor has no prior experience, but has title	6.6	63	948
3. Contractor has no prior experience and no title	2.2	4	176

[1] Computed by dividing the number utilized by the total number of observations.

[10] It is not possible to state categorically that exclusive rights in themselves are responsible for the shift in utilization since contractors had the option to acquire or waive title to most of these inventions under DOD contracts, and presumably waived title only when the invention clearly was of no use to them.

Significantly, prior experience has an even greater effect on utilization than does ownership of the patent, as the case studied in Volume IV, part II confirm. Interviews of 10 high and 11 low utilizers showed that, in most large firms, the decision to use a government invention is quite separate from the decision to patent. Most frequently the decision to patent is based on a desire to ensure freedom of design, to protect against infringement suits, to cross license, to recognize employee inventiveness, to to enhance the firm's image. In most instances, utilization counts only as a speculation that the invention may have some commercial use. Tables 9 and 10 provide some measure of the weight given the commercial value of government inventions by these firms. With the exception of three companies who do most of their business with the government, all file one-third or less of their patent applications on government-sponsored inventions.

b. Field of Technology, Size of Firm, and Percent Government Business.

Three other factors—the field of technology, the size of the firm, and the percent government business—were found to affect the rate of commercial utilization statistically.

Table 11 shows that mecahnical inventions have a higher rate of utilization than inventions in other fields of technology. Prior experience agains strongly influences utilization, but apparently less for mechanical inventions than for those in other fields of technhology.

The combined effect on utilization[11] of size of firm and percent government business is shown in Figure I–1. As we have already discussed, large firms in government markets tend to patent for reasons more than planned use of the invention, resulting in their lower rates of utilization as shown in Figure I–1. Case studies show that some firms who do most of their work for the government do not try to apply the inventions commercially and, therefore, have low rates of utilization. Smaller firms and those more oriented to commercial markets achieve higher utilization because they patent more selectively and have the necessary experience to develop market innovations in their product lines.

Even for firms with the highest rates of utilization, however, the amount of utilization is very small when measured in sales. Thus, the factors affecting utilization, described above, affect it only within a narrow range of performance. The most basic factor, as noted in Volume IV, Part II, is the commercial potential of the sample inventions and all other factors make a difference only when inventions reach a minimum threshold of commercial utility. Not many of the inventions involved in the study have reached that point.

c. Industry Attitudes Toward Patents on Government-Sponsored Inventions.

(1) *Introduction.*—Industry's attitudes toward patents on government-sponsored inventions are an important factor in utilization even though these attitudes cannot be evaluated statistically. The 21 high and low utilizers of contractor inventions interviewed in the survey were found to have six dominant attitudes toward patents, which condition their reaction to government patent policy and govern

[11] The rate of commercial utilization is computed differently in Figure I–1 than in the Table 6 above. Utilization percentages in Table 6 represent a group's share in all inventions used. Utilization rates in Figure I–1 represent the percent of a group's holdings that it has been able to utilize.

their actions in participating in, and using the inventions of, government programs. Firms were classed as high utilizers if they used more more than 12 percent of their inventions commercially and as low utilizers if they utilized less than 7 percent.

Figure I–2 categorizes the 21 companies according to dominant attitudes, size distribution, and industry. As shown in Tables 12 and 13, these firms account for 53.7 percent of the survey inventions, 131 of the 210 utilized inventions, and, at least, $179 million of the $406 million in sales reported for contractor inventions.

(2) *Patents Have No Importance.*—A lack of interest in patents was characteristic of some research-oriented and manufacturing firms that do either a preponderance or a large percentage of their business in the government aerospace and defense markets. Three such firms—Companies A, F, and K, ranging in size from the $5 to $50 million category to over $200 million in annual sales (see Figure I–2)—indicated no desire to expand into commercial markets and no mechanism for the commercialization of inventions. These three firms account for only 1.8 percent of the inventions of the companies interviewed. Although Company A is shown as a high utilizer in Table 12, its attitude toward patents has changed since the early sixties, and it no longer pursues commercial utilization of inventions developed by its government divisions. When these firms (A, K, and F) obtain patents under government contracts, their sole purpose is recognition of technical competence within the company.

TABLE 9.—INTERNAL PATENT MANAGEMENT—10 HIGH UTILIZERS

Company	Size of firm (millions)	Percent Government business	Number of applications filed per year (approximate)	Percent Government-sponsored applications [1]	Percent company-sponsored applications [1]
Q	Over $1,000	65–80	(2)	20	80
S	Over $1,000	40	960	12	88
A	$200 to $1,000	40	75	33⅓	66⅔
G	$200 to $1,000	30–40	150	15	85
R	$200 to $1,000	10	500	10	90
E	$50 to $200	85	125	14	86
H	$50 to $200	75	75	25–30	70–75
N	$50 to $200	70	140	25	75
M	$5 to $50	10–40	25–30	25	75
J	Under $5	20–50	(2)	(2)	(2)

[1] Percentages are approximate.
[2] Not available.

TABLE 10.—INTERNAL PATENT MANAGEMENT 11 LOW UTILIZERS

Company	Size of firm (millions)	Percent Government business	Number of applications filed per year (approximate)	Percent Government-sponsored applications [1]	Percent Company-sponsored applications [1]
B	Over $1,000	80	1, 000–2, 000	2–5	95–98
C	do	2	510	1(—)	99+
I	do	75	300–350	33⅓	66⅔
O	do	50–90	70	25	75
P	do	95	175–200	50	50
T	do	30	600	10–15	85–90
D	$200 to $1,000	10	1, 000	[3] 0	[3] 100
U	do	55–70	250	20	80
F	$5 to $50	85	(2)	(2)	(2)
K	do	90	5–6	100	0
L	Under 5	(2)	30	65	35

[1] Percentages are approximate.
[3] Since 1962.
[2] Not available.

TABLE 11.—EFFECT OF FIELD OF TECHNOLOGY ON UTILIZATION

	Commercial use with title and prior experience		Commercial use with title but no prior experience	
	Percent	Observations	Percent	Observations
Mechanical inventions	33.3	40/120	11.0	25/227
Inventions in other fields of technology	20.6	89/431	5.2	38/725

FIGURE I–1.—Relationship among size of firm, percent Government business, and the rate of commercial utilization [1]

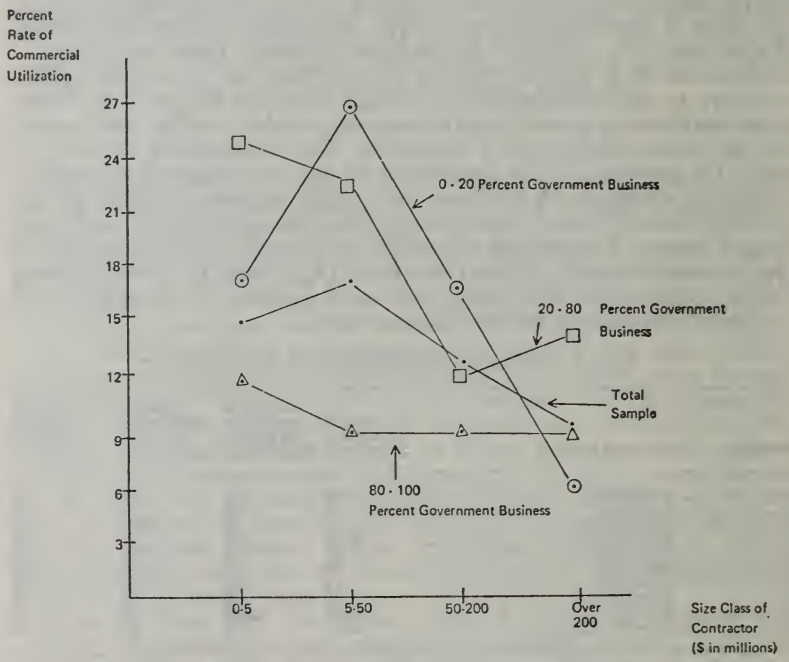

FIGURE I–2.—Dominant Industrial Attitudes Toward Patents Among Ten High and Eleven Low Utilizers

[Contractor Inventions]

1. Patents have no importance
   Company F–$5–50 million*—Industry 4**—85 percent.***
   Company K—$50–200 million—Industry 6—90 percent.
   Company A–$200–1 billion—Industry 3—40 percent.

2. Patents are of little value, compared with technical know-how
   Company E–$200 M–1 billion—Industry 4—85 percent.
   Company B–Over $1 billion—Industry 5—80 percent.
   Company O–Over $1 billion—Industry 1—50–90 percent.
   Company P–Over $1 billion—Industry 1—95 percent.
   Company Q–Over $1 billion—Industry 2—65–80 percent.
   Company U–$200 M–1 billion—Industry 3—55–70 percent.
   Company R–$200 M–1 billion—Industry 2—10 percent.

[1] Defined as patents in commercial use/patents in response.

3. Patents are valuable for defensive purposes
   Company B–Over $1 billion—Industry 5—80 percent.
   Company G–$200 M–1 billion—Industry 5—30–40 percent.
   Company H–$50–200 million—Industry 5—75 percent.
   Company I–Over $1 billion—Industry 5—75 percent.
   Company O–Over $1 billion—Industry 1—50–90 percent.
   Company P–Over $1 billion—Industry 1—95 percent.

4. Patents are important in establishing proprietary positions
   Company C–Over $1 billion—Industry 7—2 percent.
   Company J–Under $5 million—Industry 6—20–50 percent.
   Company L–Under $5 million—Industry 6—N/A.****
   Company T–Over $1 billion—Industry 3—30 percent.

5. Patents are essential to business activities
   Pattern 1
      Company L–Under $5 million—Industry 6—N/A.
      Company M–$5–50 million—Industry 7—10–40 percent.
      Company N–$50–200 million—Industry 4—70 percent.
   Pattern 2
      Company C–Over $1 billion—Industry 7—2 percent.
      Company D–Over $1 billion—Industry 7—10 percent.

6. Patents are judged differently in commercial and government work
   Company C–Ove4 $1 billion—Industry 7—2 percent.
   Company D–Over $1 billion—Industry 7—10 percent.
   Company S–Over $1 billion—Industry 3—40 percent.

*Indicates range of annual sales at time survey patents were issued.
**Industry Key:
1 Military & Space Systems & Airframe Manufacturers
2 Aircraft Engines & Components Manufacturers
3 Diversified Products & Service Firms (military & commercial)
4 Instruments, Components & Subsystems Manufacturers
5 Electronic & Communications Equipment Manufacturers
6 R & D Firms.
7 Commercial Product Firms
***Indicates approximate percent government business during sample years.
****Not available.

TABLE 12.—INVENTION UTILIZATION 10-HIGH UTILIZERS (CONTRACTOR INVENTIONS)

	Rank in patent holdings[1]	Patent holdings				Number utilized	Number[2]	Total[3]
		Title	License	Number	Percent of sample			
Company:								
S	1	153	21	174	7.8	43	3	3.0
R	6	100	0	110	5.4	13	2	7.2
Q	10	52	4	56	2.7	13	1	1.0
E	14	36	0	36	1.7	5	1	1.0
H	20	22	0	22	1.0	7	0	0
A	22	20	0	20	.9	7	1	0
G	24	15	4	19	.9	4	2	70.0
J	25	18	1	19	.9	3	0	0
N	31	13	0	13	.6	5	3	22.2
M	45	8	0	8	.3	3	1	1.25
Total				477	22.2	103	14	107.65

[1] Ranked based on holdings of both title and license to inventions in the survey sample.
[2] Number utilized with commercial sales over $1,000,000.
[3] Total commercial sales (million-dollar inventions).

(3) *Patents Are of Little Value, Compared with Technical Knowledge.*—Firms expressing this attitude toward patents generally are manufacturers of such complex systems and technical products as aircraft, jet engines, computers, or communications equipment. Although as much as 75 percent of their sales may be directly to the government, these firms frequently sell similar products to commercial markets. Inven-

tions developed during the course of R&D activities tend to be auxiliary components and subsystems or incremental improvements to the basic product, not as important in sustaining sales or selling new products as are the basic engineering management and production capability of the firm. New ideas and inventions are incorporated in product modifications or in new models and little consideration is given to the protection offered by patent rights. Using a new idea to enhance product performance is regarded as more important than assuring that the company owns the exclusive right to use it.

The seven firms with this attitude, three of whom are also listed under the attitude which follows, all have annual sales over $200 million (see Figure I–2). They include three high and four low utilizers, who as a group, hold 22.9 percent of both the survey patents and 36.6 percent of the utilized inventions. More importantly, however, these seven firms are responsible for $81.2 million, or almost half, of the sales of the entire group of high and low utilizers. Just three inventions, however, account for $79.2 million of that, showing again the "sweepstakes" effect in utilization of government-sponsored inventions.

(4) *Patents are Valuable for Defensive Purposes.*—Some firms believe strongly that corporate ownership of patents is important to maintain flexibility in design, both in the United States and abroad (through ownership of corresponding foreign patent rights), and to provide trading material for cross-licenses with competitive firms. Ownership of a patent as a prerequisite for new product development, however, is a relatively minor factor with these firms compared with market and investment considerations associated with commercialization of the invention. Five of the six firms with this attitude are large companies with sales over $200 million. The sixth, Company H, has sales in the $50 to $200 million range (see Figure I–2). The three new firms, (Companies G, H, and I) included here hold about 8 percent of the patents and utilization, including one highly used invention, contributing $70 million in sales to its owner.

A change in government patent policy may affect some firms in this category by causing them to choose more carefully the areas in which they are willing to undertake government research. Faced with the possibility of being unable to obtain title to patents they develop, these firms may refuse to contract in research areas that would impair their operational flexibility.

TABLE 13.—INVENTION UTILIZATION 11-LOW UTILIZERS (CONTRACTOR INVENTIONS)

	Rank in patent holdings	Patent holdings				Number utilized	Number[1]	Total[2]
		Title	License	Number	Percent of sample			
Company:								
I	2	84	47	131	6.5	5	0	0
B	4	118	1	119	5.8	5	1	22.0
T	5	67	50	117	5.7	3	0	0
P	7	75	7	82	4.0	5	0	0
C	9	57	5	62	3.0	0	0	0
U	12	39	3	42	2.0	3	2	50.0
O	16	30	0	30	1.4	4	0	0
L	19	26	0	26	1.2	0	0	0
D	21	13	9	22	1.0	3	0	0
F	35	11	0	11	.5	0	0	0
K	39	8	1	9	.4	0	0	0
Total				651	31.5	28	3	72.0

[1] Number utilized with commercial sales over $1,000,000.
[2] Total commercial sales (million-dollar inventions).

(5) *Patents Are Important in Establishing Proprietary Positions.*—Firms having this attitude actively seek ownership of patents to establish and maintain proprietary positions in new technologies as well as in established product areas. Invariably, however, estimates of market potential and corporate investment requirements determine which product areas are developed. The makeup of the patent portfolio of these firms may indicate the direction for product development in order to strengthen proprietary positions, but development is rarely, if ever, undertaken solely because patent protection is available.

Of the four firms showing this attitude, two (J and L) are small (less than $5 million sales) and two (C and T) are large (more than $1 billion in sales). One of the small firms is a high utilizer; the other small firm and the two large firms are low utilizers. The large firms hold 8.8 percent of the patents and about 2.3 percent of the utilizations. The small firms hold 2.1 percent of the patents and 1.5 percent of the utilizations. The low record of utilization by the small firms in this group masks their importance as potential commercializers of government inventions. They actively seek new product ideas in the R&D work they perform and, consequently, they have very different outlooks from the firms described under (2) above. That their utilization is low is partially due to the fact that they often participate in advanced R&D government programs where the chances for immediate commercial spillover are small.

A change in government policy from license rights to title rights would limit the government-sponsored R&D activity of firms in this category because of possible conflict with company-sponsored research activities. These companies wuold examine contract opportunities on an individual basis and, in many cases, might refuse to contract with the government.

(6) *Patents Are Essential to Business Activities.*—Firms in this category regard patent rights as essential to their business activities, and are careful to avoid government claims or conflicts over ownership of inventions Their policies generally lead them into one of two. business patterns. In the first pattern, firms will assure corporate ownership of patents before initiating work on a government contract, either by negotiating contracts that permit them to acquire title to patents on inventions they may develop, or by developing and patenting basic inventions with limited private funds and then seeking contract work in order to develop additional technical competence, push the state of the art, explore a new technology, or determine if commercial applications may begin to be drawn off. In these situations, firms deliberately select areas of government research to match their commercial interests in order to generate product ideas with commercial possibilities. New research firms with strong technical abilities and limited capital typically follow this pattern, as do specialized firms that have concentrated their business in a limited area of technology. The three firms in the first pattern (L, M, and N) are small to medium-sized companies, ranging from less than $5 million in sales to $50 to $200 million. One of these (company L) is included under (5) above; the other two hold .9 percent of the inventions and account for about 6 percent of the utilizations. Though these holdings are small, one of the two (N) has three inventions which account for $22.2 million, or about 12 percent of the total sales of inventions by high and low utilizers.

In the second pattern, firms isolate government work from their commercial operations and pursue these activities separately. Frequently, inventions derived from government contract work will be assigned automatically to the government to avoid title conflicts or commingliny wish company-sponsored R&D. In other cases, government R&D will be undertaken only in areas where there is no potential conflict with corporate properietary objectives and in order to enhance the corporate image. The technical value of government contracts to the commercial interests of these firms is rarely considered a valuable supplement to in-house research and development.

The two firms in the second pattern (C and D) are large firms with more than $1 billion in sales. They hold 4 percent of the inventions and account for 2.2 percent of the utilizations. Those firms following the second business pattern have no proprietary expectations from government contracts. Any change in government patent policy with respect to license and title rights would have little effect on them since they have already divorced their main corporate interest from government contract work and do not regard government-sponsored R&D as a source of commercial ideas.

Firms following the first pattern, however, would be severely affected by a change in policy since their business activity is based largely on government-sponsored research that may develop commercial applications. Corporate ownership of patents is, therefore, an essential feature of the growth strategy of such firms. If title to inventions arising from government-sponsored research were to become unavailable, such firms would have to either change their mode of business or refuse to contract with the government.

(7) *Patents Are Judged Differently in Commercial and Government Work.*—Many diversified companies follow different patent policies in their commercial and government markets. These firms may place a strong emphasis on maintaining proprietary positions in commercial markets and express a relative lack of interest in patents arising from government work. It is difficult to generalize about these firms except to note that their policies tend to follow the patterns of the industries in which their divisions participate. Their behavior may, therefore, resemble any of the categories of firms described above if their divisions have similar business profiles.

All three firms in this category (Companies C, D, and S) are large companies with more than $1 billion in sales. Two (C and D) are included under (6) above. The third firm holds 7.8 percent of the patents and accounts for about 32 percent of the utilizations. Though it has used a large number of its government inventions, these inventions generally have played a supporting role. Only three represent significent sales, amounting to $3.0 million at the date of the survey.

(8) *Overall Effect of Policy on Utilization.*—Notwithstanding the varing roles assigned patent rights by the firms described above, the key question is whether permitting them to retain exclusive rights will, on balance, promote utilization better than acquisition of title by government. The study data indicate that the answer is yes where the inventions as developed under government contracts are not directly applicable to commercial uses and the inventing contractor has commercial experience in the field of the invention. This occurs most frequently with DOD, NASA and AEC inventions. In the case of DOD, the fact that it does not actively promote commercial

use of its patents is an added factor. In these instances the inventing contractor with commercial experience appears to be the logical candidate to attempt utilization either directly or by licensing others. The answer is also yes where the invention is commercially oriented but requires substantial private development to perfect it, applies to a small market, or is in a field occupied by patent sensitive firms and its market potential is not alone sufficient to bring about utilization. Inventions in this category may arise with any agency and may have had only limited development toward a commercial application by the government itself.

2. Public-Service Agency Inventions

The public-service agency inventions all achieved utilization without exclusive rights. Utilization was achieved primarily because the inventions were highly commercial in nature and because they were extensively developed and promoted by the sponsor agencies.

a. Commercial Nature of the Inventions

The consumer orientations of the public-service agency inventions makes them more attractive to prospective users than inventions—such as those of DOD—which are not originally intended for public use. (The utilized inventions of public-service agencies are identified in Table 14.) [12] The inventions that achieved the greatest success—potato flakes developed by the Department of Agriculture and the fertilizer inventions of TVA—all are used in products having broad consumer demand. The sugar beet extraction process, another important Agriculture invention, provides the sugar beet extraction industry with a cheaper and more convenient process for extracting water in the manufacturer of beet sugar. The dialdehyde starch inventions (Agriculture) have applications as wet-strength paper additives; the foam-mat process (Agriculture) provides one of the most inexpensive ways of dehydrating foods; the cotton opener provides a more efficient method for opening, cleaning, and blending cotton; and synthetic mica has a wide range of uses as a superinsulator in the electrical and electronic industries.

Even the inventions that have not been used are commercially oriented (Table 15). Among these are two processes for desalination of water, a mechanical crabpicker, a method for preserving walnuts, a process for flameproofing fabrics, a textile fiber cleaning machine, and a process for extracting oil from shale. As shown in Table 15, the reasons for their nonutilization are largely technical and relate to the invention's state of development.

b. Role of Agency Mission—Development and Promotion

It is not coincidental that these inventions originate with the public-service agencies since the missions and R&D programs of these agencies are oriented toward the civilian economy. To the extent that they select their research to fulfill civilian needs, these agencies function—with one essential difference—like industrial firms looking for new markets: Since they are not required to earn a profit, they are freer than most industrial organizations to sponsor high-risk research with future, rather than imminent, utilization prospects. This pattern is particularly significant with Agriculture and TVA

[12] Case studies of these inventions are presented in Volume IV, Part III.

since their programs benefit conservative industries, such as food, textile, or fertilizer, which perform little of their own research or development. These agencies have become, to a large extent, the research arm of these particular industries. This relationship is noted in a number of the cases in Volume IV where the companies involved attribute lack of utilization to the government's failure to carry development of the invention far enough.

The extent of development undertaken by these agencies is a second major factor in achieving utilization of these inventions without exclusive rights. Research shows that the agencies have to develop the inventions extensively for commercial use before firms will attempt application without patent protection.

The Department of the Interior experience illustrates the importance of full development. Much of its research—particularly in water desalination, coal, and oil—is basic in nature and parallels work being performed by research- and development-oriented firms that are sensitive to patent rights. And although Interior's research has great commercial potential, the technology involved is speculative and commercially feasible inventions are still in the development stage. Industry has hesitated, in many instances, to undertake private commercial development of these inventions without patent protection. Here, nonexclusive rights have not been as effective as with Agriculture and TVA inventions. When research is performed under contracts, patent rights are often an issue (see Volume II, Part IV) and resulting inventions, because they are not yet economically feasible, do not spark wide interest in industry. Similar reactions are found in the government's health programs, discussed in Volume II, where drug firms will not use the results of HEW research if these results appear to conflict with their patent position.

TABLE 14.—UTILIZED INVENTIONS (PUBLIC-SERVICE AGENCIES)

Case and sponsor agency	Government patents involved	Additional inventions (trade secrets/patents)	Licensees/utilizers	Investment [1]	Annual market [2]
1. Dialdehyde starch: Agriculture.	8	Secrets and patents.	1/1	About $2,500,000	About $750,000.
2. Synthetic mica: Interior	1	Secrets	2/2 [3]	About $2,000,000	About $600,000.
3 and 4. Liquid and mixed fertilizer process: TVA.	4	None	130/many [3]	About $40,000	About 3,000,000.
5. Cotton opener: Agriculture	1	Secrets and patents.	13/3 [3]	About $40,000	About $140,000.
6. Superphusphoric acid: TVA	1	None	3/1	N/A [4]	N/A. [4]
7. Sugar beet extraction: Agriculture.	2	None	1/more than 1 [5]	N/A [6]	N/A. [6]
8. Foam-mat process for drying foods: Agriculture.	3	Patents	4/1	About $300,000	N/A. [7]
9. Low-temperature phase equilibria cell: [8] Interior.	1	Unknown	1/more than 1 [5]	N/A [9]	N/A. [9]
10. Potato flakes: Agriculture	3	Patents	6 or more	Unknown	$8,000,000.

[1] Investment of "most successful" utilizers in case where more than 1 attempt took place.
[2] Current annual market of "most successful" utilizer.
[3] Case research on all licensees was not performed for the study. Number of licensees reflects licensees under most "popular" of patents involved in the product.
[4] A process for turning out an existing product—acid manufactured by new process probably amounts to several million dollars; investment estimates were not available.
[5] Firms other than those licensed are believed to practice the invention.
[6] A process improvement invention used by a company with $40,000,000 sales. No breakout of investment or contribution of invention available.
[7] Current market is only in pilot plant design and installation.
[8] Government sources believe this invention to be in use although single licensee declined to be interviewed.
[9] Only known utilizer declined to be interviewed.

TABLE 15.—NONUTILIZED INVENTIONS (PUBLIC-SERVICE AGENCIES)

Case and sponsor agency	Patents involved	Licensees	Reasons for nonutilization	Private investment
11. Solar Still: Interior	1	1	Only technical feasibility demonstrated; government now funding alternative methods.	None.
12. Electrolytic process for desalination of water: Interior.	1	1	Development work not finished	None.
13. Hydrate process for desalination of water [1]: Interior.	5	1	Development work not finished; patent rights issue with firm.	$495,000.
14. Centrifugal compression distillation: Interior.	1	1	Utilization tried but severe technical problems encountered.	Some.[3]
15. Shale oil: Interior	1	1	No market need yet, although thought to have promise; patent rights problems.	Some.[3] [2]
16. A calcium carrying agent for medicinal applications: Agriculture.	1	1	Research notjyet complete; thought to have promise.	$100,000.
17. Gelsoy (manufacture of sausages): Agriculture.	1	1	Lack of availability of raw material: no USDA follow through.	Some. [2]
18. Textile fiber cleaning machine: Agriculture.	1	4	Utilization tried but severe technical problems encountered.	$20,000.
19. Flameproofing of fabrics: Agriculture	5	5	Chemical and raw material problems	About $80,000.[3]
20. Coumarone derivatives: Agriculture	1	1	Technical problems; reorganization of firm.	None?
21. Preservation of walnuts: Agriculture	1	1	More practical alternative method developed concurrently.	Some.[4]
22. Vinyl 9,10-epoxystearate: Agriculture	1	1	Chemical limitations and high cost relative to other methods.	None.
23. Honeycomb (uncapping apparatus): Agriculture.	1	25	No market need; too complex for commercial application.	None.
24. Deamidized gliadin: Agriculture	1	1	No market need; licensee not in business related to potential use.	
25. Mechanical crabpicker: Interior	1	2	Development unsuccessful to date	None.

[1] This case also documented in vol. II.
[2] Records not available.
[3] Amount spent by only one of several commercial firms attempting to utilize.
[4] Development undertaken on cooperative basis with USDA (amounts not available.)

Development alone, however, may not insure commercialization of public-service agency inventions without exclusive rights. Often intensive promotion is needed to convince potential users of the invention's commercial value. For example, the Department of Agriculture market tested potato flakes in supermarkets before food processors picked up the invention. TVA has had similar experiences with with fertilizers it developed. Both agencies employ a variety of techniques to promote the use of new products which make industry aware of valuable innovations developed by the government and which stimulate demand.[13] Thus, it appears that, in most cases, three factors contributed to commercial utilization of these inventions without exclusive rights: The inventions were commercially oriented and there were a clear need and market demand for them; the government undertook extensive development of the invention in its commercial form; and the government promoted industry interest in the invention.

Several firms studied did achieve utilization of government-sponsored inventions without these three factors. These companies picked up inventions in various stages of government development and went on to devise new products based on the original patents. As shown in Table 14, these firms often gain protection by patenting improvements to the original invention or by trade and processing secrets growing out of their own research. Here, government patents, although not utilized in their original form, have stimulated private research that led to commercial products. The utilization achieved by this method is not readily measurable, but it is significant.

[13] Promotional approaches by government agencies are discussed in Volume III.

3. Transfer of Technology in the Nonprofit Environment

a. Licensing Programs.

Inventions arising out of nonprofit research do not travel the same route to commercial utilization as inventions arising out of industrial research. While there is much variation in the policies and practices of educational and nonprofit research institutions, we found more similarities than differences among them when contrasted with industrial commercialization practices. The nonprofit institutions do not make or sell the products and processes embodying their inventions and must license these inventions in order to have them used. Therefore, these institutions have evolved a variety of licensing techniques to transfer technology from nonprofit research programs to the marketplace.

Some colleges and universities, such as those discussed in Volume IV, Part IV, Cases 1, 3, and 6 have their own licensing programs. These programs call for processing patents through special administrative units that are responsible directly to the administration of the senior policy-making group in the institution.

Other colleges and universities administer patents as a part of the routine duties of established offices and faculty committees. At the state university discussed in Case 2, for example, the dean of the graduate school is chairman of the patent committee. An office of research services, which is responsible for administration of sponsored research, provides the necessary administrative support. Here, as in other institutions which lack formal licensing programs, the administrative arm of the school ensures that pertinent institutional regulations are observed, that there is compliance with invention-reporting requirements of government contracts, and that the rights of the parties involved are guarded in the rare case of a decision to patent an invention.

Many educational institutions administer patent programs through independent foundations, for various legal, financial, and policy reasons that are only occasionally related to invention utilization. In these instances, the invention is assigned to the foundation either by the institution or by the inventor himself. The technical institute in Case 6 and the liberal arts college in Case 9 administer their patent programs in this way. The reasons for establishing such foundations include:

—Insulating patent funds from use by the state agency, or even by the university itself, for purposes other than financing scientific research;

—Creating a buffer between the nonprofit institution and industrial licensees in the event of litigation;

—Limiting contractual and tax liabilities;

—Providing a degree of flexibility in relationships between the nonprofits and industry not possible with the nonprofit institution alone;

—Facilitating a continuing relationship between the inventor and and the licensee in order to develop the invention.

In many instances, a patent administration foundation was created to relieve the institutional administrative staff of the complicated and time-consuming technical and commercial problems of patent manage-

ment. However, as additional duties were delegated, a number of the 50 to 60 such foundations retained patent development firms like those discussed in Cases 15 and 16, below, to manage their patent portfolios.

The principal agent for the transfer of the patentable products of nonprofit research to industry is the patent development firm. Of the 349 institutions described by Palmer,[14] 212 have contracts with patent development firms; in our investigation, all but three of the institutions having patent programs were also found to have contracts with such firms. Some patent development firms serve a restricted clientele or a limited technological market. Only three firms offer their services in invention marketing to all educational institutions, foundations, and nonprofit research corporations. The services of patent development firms include:

—Evaluation of disclosures.
—Assistance in preparation of patent applications.
—Negotiation of licenses.
—Distribution of royalties.
—Policing the patent.

The firms act as a clearinghouse for the nonprofits and as a marketplace for industry. Patents are typically assigned to the patent development firm on a royalty-sharing basis. Patent applications are filed on approximately 10 to 15 percent of the disclosures submitted and, if present circumstances continue, only one-quarter of these patents will ever be licensed.

b. Characteristics of Inventions of Nonprofit Institutions.

Inventions arising out of nonprofit research have a distinctly different character than the patentable ideas arising from R&D contracts with industry. In nonprofit research, the end product is normally "software"—scientific findings—and patentable ideas take the form of concepts rather than hardware. In industry R&D, on the other hand, the result is usually "hardware"—a product, process, or component—and a working model, at least, will have been developed.

The task of a nonprofit organization is over and the contract has been fulfilled when the organization submits a research report. Funds rarely available to reduce the discovery to any practical application, and interest and motivation to seek utilization are often also absent. The idea of following an invention through development and production to a marketable product is alien to the academic and nonprofit environment. For this reason, the patent licensing profession refers to academic invention as a "bare bones patent." Industry must take it from there.

In contrast, under comparable government research contracts, the industry contractor normally seeks to promote follow-on work that will further develop his findings—ultimately, into a product. Should contract research result in an invention with commercial possibilities, in-house funds may be assigned to develop and exploit it.

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[14] A comprehensive survey of the patent policies, practices, and procedures of universities, technological institutions, and nonprofit organizations was commissioned by the Patent Policy Survey of the National Research Council (National Academy of Sciencies) in 1946. Dr. Archie M. Palmer published five monographs between 1952 and 1962 depicting the patent activities of the 945 institutions, with a description of the situation at each of the 349 institutions which conduct scientific and technological research and have invention policies.

Nonprofit research inventions usually require a larger investment for commercialization than industry discoveries because nonprofit inventions are frequently at an earlier stage of development. In our investigation, the nonprofit institutions repeatedly emphasized the additional investment industry has made to develop products based on nonprofit discoveries. In Case 1, for example, the industrial licensee invested a quarter of a million dollars in the tomato harvester after eleven years of university research developed a patentable prototype. The patent development firm in Case 16 has already made a comparable investment in seeking applications of holography, and still the patented disclosures relate only to the mathematical theory of wavefront reconstruction, rather than to any marketable three-dimensional imaging device.

The institute in Case 3 has been extremely cirtical of development firms that lecense university patents to companies which are not prepared to invest the necessary development capital. In short, inventions from nonprofit concerns are grains of sand about which a pearl may be formed only if industrial development is undertaken.

Another characteristic of nonprofit inventions is that they stand alone. Their isolation is a major obstacle to utilization, since most inventions are not marketable products in themselves. (In only 55 inventions investigated by Harbridge House was the patented discovery regarded as critical to the product.) The industrial product is often protected by a cordon of patents, as illustrated by the list of patents on a packet of Polaroid film. A university invention, on the other hand, is a one-shot patent. Even if the patent specification discloses an ingenious invention, the patent claims which define the scope of the monopoly are likely to be narrowly drawn. Whereas industry will add to its patent arsenal as a product is improved, a university patent, if it is to be liecnsed at all, must be licensed on the initial effort. Thus, the patent development fimr in Case 16 did not begin to see a return on an invention which revolutionized an industry until the basic patent had run for thirteen years. By then, however, the industrial developer had patented a line of industrial improvements over the basic invention.

Industry can profitably keep an innovation "on the shelf" until the time is right to market it. Furthermore, cross-licensing agreements between firms extend the economic utility of the industrial patent. Nonprofit inventions, on the other hand, remote from the market to begin with, are perishable if unlicensed, since the nonprofit organizations do not have manufacturing operations. All the above characteristics of inventions developed by nonprofit institutions make them high-risk commercialization ventures.

c. Patenting Versus Publishing Research Results

Another major factor which affects invention utilization by academic institutions is the drive to publish research results. This drive produces a dilemma where utilization of inventions is concerned, since patents are the only protection for the inventions of nonprofit institutions. In the nonprofit environment, there is no economically useful equivalent of "proprietary data" or industrial trade secrets. While industry may benefit from these alternatives to patenting, the secrecy involved is counter to the tradition in university and nonprofit research.

This tradition reflects the relative values academic institutions place on publishing and patenting the results of their work. Publications are central to scholarly pursuit. Invariably, the results of research, except those limited by the terms of a grant or contract, are fully disclosed through articles in scientific and technical journals. Patents, on the other hand, have traditionally been regarded as irrelevant at best and, at worst, as an indication of unworthy commercial motives. All but one of the educational institutions interviewed declared that publication of research results is preferred even if, by doing so, patentability of an invention is endangered.[15] Thus, we found that perhaps the single most difficult task of a university patent administrator was the solicitation of invention disclosures. Even if the inventor was willing to cooperate in the utilization process, it was a familiar story that the university patent office only learned of the invention eight months after publication in a scientific or technical journal.

Since, under the present law, patent applications must be filed within one year of public disclosure of the invention or the patent will be banned, patentable ideas are frequently lost to an institution's portfolio. The universities, however, have never considered the industrial alternative of delaying publication until a patent is filed, resting on the comfort of one year within which to file an application. The college officials in Case 10 proposed that the government agencies retain an option to prohibit publication during a contractual evaluation period rather than require clearance prior to publication.

While nonprofit institutions actively disseminate technology through publication, promoting utilization of a specific invention is another matter. Given the academic preference for publication of research results over patenting them, a major problem exists in mounting an effective patent promotion program. As the cases illustrate, except for a few universities and technical schools, there is today little active promotion of patents by academic institutions.

Notwithstanding the low-key promotion of inventions by academic institutions, the critical question concerning utilization is whether patents would be promoted more effectively through government ownership, given their speculative utility. Research indicates that the mission-oriented and mixed-activity government agencies—DOD, NASA, and AEC—would promote patents largely through publicity. These agencies would not, as a rule, develop inventions beyond the agency mission expressed in the contract. A chance overlap in government and commercial requirements then, determines the applicability of the inventions in the commercial market. In most cases, substantial private development is required to commercialize patents, and the nonexclusive license the above agencies would offer may not compensate for the development risks involved. Allowing academic and nonprofit institutions to keep title, under these circumstances, offers greater flexiblity in providing patent protection to interested developers, when that is necessary to achieve utilization. Title also motivates the inventor to assist in developing the invention for commercial use, because of its potential rewards to him.

Inventions of public service agencies—such as TVA, HEW, and the Departments of Agriculture and the Interior—may differ from the inventions discussed above in two important respects: their close

[15] Case 1 is a qualified exception to this rule.

alignment with commercial needs, and their greater agency development and promotion for public use. Review of public service agencies [16] and their promotional programs suggests that TVA and Department of Agriculture inventions have a good chance of utilization if these agencies retain title, and invest in invention development and promotion. HEW and Department of the Interior inventions, on the other hand, require strong patent incentives for industry because of high product development costs and minimum agency development and promotion. For these inventions commercial utilization would appear to be better promoted by allowing academic and nonprofit institutions to retain title.

E. SPEED OF UTILIZATION

Survey inventions that were utilized, for the most part, found quick application. Table 16 shows the time lag between patent application and first commercial utilization of contractor inventions. About a third of the inventions had been used commercially by the time a patent application was filed, and assuming three years for patent issue, about two-thirds had been used by the time a patent was received.

TABLE 16.—TIME LAG FROM PATENT APPLICATION TO FIRST COMMERCIAL UTILIZATION CONTRACTOR ACTIVITY FOR SAMPLE YEARS 1957 AND 1962

Independent variables	≤ 0 yr	1 to 3 yr	4 to 8 yr	≥9 yr	9 yr [1]	Total
Sales of firm:						
Less than $5,000,000	3	4	2	0	3	9
$5 to $50,000,000	8	6	7	0	1	21
$50 to $200,000,000	5	11	3	3	6	22
Over $200,000,000	37	33	22	0	14	92
Total	53	54	34	3	24	144
Prior activity:						
Yes	41	36	13	2	8	92
No	12	19	21	1	16	53
Total						145
Percent Government business:						
0 to 20	16	14	20	2	2	52
20 to 50	16	10	3	0	2	29
50 to 80	10	11	1	0	7	22
80 to 100	11	20	10	1	13	42
Total						145
Field of technology:						
Mechanical	14	22	12	1	6	49
Other	39	33	22	2	18	96
Total						145
Form of invention:						
Material	12	10	6	0	2	28
Process	2	4	0	0	3	6
Component	22	17	7	1	10	47
End product	17	24	21	2	9	64
Total						145
Kind of agency:						
DOD	50	53	31	3	24	137
AEC	2	1	3	0	0	6
Other	1	1	0	0	0	2
Total						145

[1] Years between filing and first expected commercial utilization. This column is not included in the row totals.

[16] See Volume III, on government efforts to promote utilization.

Prior experience plays an important role in the speed with which inventions are used. If rapid utilization is defined as occurring in three years or less from the date of application, inventions developed by firms with prior commercial experience achieved a ratio of 77 rapid to 15 slow utilizations (see Table 16). In contrast, firms without prior commercial experience had a ratio of only 31 to 22.

The mix of government and commercial business is a second major factor which affects speed of utilization. Firms in the middle range of government activity (20 to 80 percent government business) use inventions much more quickly than companies who are predominantly in the commercial or the government market. These middle range firms have a ratio of 47 rapid to 4 slow utilizations compared with 61 rapid to 33 slow for the other companies, due, at least in part, to the fact that firms with both low and high proportions of government activity separate their government and commercial work to a greater extent than do the firms in the medium range of government activity.

F. REASONS FOR NONUTILIZATION

The survey questionnaire asked contractors and licensees to enumerate reasons for nonuse of government inventions in which they had rights. In each case, responders were asked to rank 10 different reasons according to their importance in the decision not to utilize. Significant differences which appeared in the answers of contractors and licensees are summarized in Tables 17 and 18.[17]

1. Contractor Inventions

Contractors indicated that the low commercial potential of their government inventions is the greatest barrier to utilization. Over 70 percent of the first-ranked reasons in Table 17 are in this category.[18] These inventions are derived mainly from defense programs and most are too far removed from consumer needs to be truly useful commercially. Developed under hardware programs in many instances, they represent applied engineering to meet a specific requirement and, thus, their application to other products is limited. Developed under more basic research in other cases, they are still too speculative to find quick commercial application. There are notable exceptions with high potential—transistors, vacuum tubes, numerical control devices, computers and gas turbine engines—as noted earlier in connection with sales, but the exceptions prove the rule since these inventions have commercial applications which closely parallel their government uses.

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[17] In Tables 17 and 18, the first row indicates the number of times a reason was ranked first, the second row, the number of times a reason was ranked second, and so forth.

[18] These reasons include no commercial potential seen (420), technology too sophisticated (171), expected market failed to materialize (208), and invention became obsolete (236).

TABLE 17.—REASONS FOR NONUTILIZATION OF INVENTIONS (CONTRACTOR INVENTIONS, 1957 AND 1962)

[Frequency/percent]

Reason for no commercial utilization	No reason given	Development costs too high	Development revealed serious flaws	Development personnel not available	Invention became obsolete	Expected market failed to materialize	Technology too sophisticated	Too much competition	Channels of distribution lacking	Invention falls outside of company product line	No commercial potential seen	All other	Total reasons given
Rank of reason													
1—Frequency	244	20	21	6	236	208	171	10	26	234	420	102	1,454
Percent		[1] 1.4	1.4	0.4	16.2	14.3	11.7	0.7	1.8	16.1	28.9	7.0	
2—Frequency	1,116	80	23	4	76	78	62	26	43	67	86	37	582
Percent		13.7	4.0	0.7	13.1	13.4	10.7	4.5	7.4	11.5	14.8	6.3	
3—Frequency	1,470	22	15	5	22	34	17	28	17	48	10	10	228
Percent		9.6	6.6	2.2	9.6	14.9	7.5	12.3	7.5	21.0	4.4	4.4	
4—Frequency	1,611	3	7	3	35	6	5	8	6	12	1	1	87
Percent		3.4	8.1	3.4	40.3	6.9	5.8	9.2	6.9	12.7	1.5	1.5	
5—Frequency	1,635	1	1	7	10	34	3	1	3	2	0	1	63
Percent		1.6	1.6	11.1	15.9	54.0	4.8	1.6	4.8	3.2	0	1.6	

[1] Percentage is the total responses for a reason, divided by the total reasons given for that row.

TABLE 18.—REASONS FOR NONUTILIZATION OF INVENTIONS (NONINVENTOR LICENSEES OF GOVERNMENT-OWNED PATENTS, 1957 AND 1962)

[Frequency/percent]

Reason for no commercial utilization	No reason given	Development costs too high	Development revealed serious flaws	Development personnel not available	Invention became obsolete	Expected market failed to materialize	Technology too sophisticated	Too much competition	Channels of distribution lacking	Invention falls outside of company product line	No commercial potential seen	All other	Total reasons given
Rank of reason													
1—Frequency	23	9	16	0	8	5	3	0	0	19	2	7	69
Percent		13.1	23.2	0	11.6	7.3	4.3	0	0	27.6	2.9	10.1	
2—Frequency	53	6	2	2	2	4	1	0	1	5	3	13	39
Percent		15.4	5.1	5.1	5.1	10.3	2.6	0	2.6	12.8	7.7	33.3	
3—Frequency	74	1	2	0	2	2	6	0	1	1	0	3	18
Percent		5.5	11.1	0	11.1	11.1	33.3	0	5.5	5.5	0	16.7	
4—Frequency	80	0	1	0	1	7	1	0	1	1	0	0	12
Percent		0	8.3	0	8.3	58.3	8.3	0	8.3	8.3	0	0	
5—Frequency	82	1	0	1	6	1	0	0	0	1	0	0	10
Percent		10.0	0	10.0	60.0	10.0	0	0	0	10.0	0	0	

[1] Percentage is the total responses for a reason, divided by the total responses given for that row.

Table 19 which groups the reasons and responses in the two categories of technical and marketing shows the effect of prior experience, patent rights, percent government business, and size of firm on nonutilization. Of the four factors, patent rights have the greatest effect on whether nonutilization was attributed to technical or marketing reasons. Technical reasons for nonutilization rate 15 percent higher when the contractor has title than when he does not. Interviews with firms in the survey indicate that this is caused by contractor's normally not taking title when the inventions clearly appear to have no utility. Thus a marketing reason is inherent in the decision not to take title. Even where contractors own the patents, however, marketing reasons still predominate since contractors often take title when utilization is only a speculative possibility, resulting in ownership of many inventions with low commercial potential.

Table 19 also shows the parallel effect of prior experience and percent government business. With both factors, greater contact with commercial markets appears to increase the percentage of patents acquired that have commercial potential, resulting in a smaller number of inventions eliminated for marketing reasons.

2. Government-owned Inventions

In contrast with contractors, licensees of government-owned inventions found development costs and development flaws rather than low commercial potential an important barrier to utilization. Those two reasons were ranked first in 35 percent of the responses (Table 18) compared with 2.8 percent for the contractor group (Table 17). The market orientation of the firm is also a more important factor with licensees than with contractors: That the invention was outside company product lines was ranked first in 27 percent of the licensee responses (Table 18), compared with 16 percent for contractors (Table 17).

TABLE 19.—FACTORS AFFECTING REASONS FOR NONUTILIZATION OF INVENTIONS

Utilization factor	Technical reasons for nonutilization (percent)	Marketing reasons for nonutilization (percent)	Observations
Contractor has prior experience	39.7	60.2	405
Contractor has no prior experience	31.6	68.3	958
Contractor has title	35.9	64.0	1,187
Contractor has no title	21.0	78.0	176
Contractor does more than 50 percent of his business with the government	29.7	70.2	841
Contractor does less than 50 percent of his business with the government	40.9	59.0	522
Contractor has annual sales over $50,000,000	33.8	66.1	1,177
Contractor has annual sales under $50,000,000	34.0	65.9	186

TABLE 20.—EFFECT OF PRIOR EXPERIENCE ON REASONS FOR NONUTILIZATION (GOVERNMENT-OWNED INVENTIONS)

	Technical reasons (percent)	Marketing reasons (percent)	Observations
Prior experience	76.4	23.6	17
No prior experience	50.0	50.0	44

Table 20 measures the effect of prior experience on licensees' reasons for nonutilization of inventions. Both with and without prior experience, technical reasons are more important to licensees (76.4 percent with experience and 50 percent without) than to contractors (39.7 percent with experience and 31.9 percent without—see Table 19). Licensees with prior experience, however, rate technical reasons more important than those without it. Interviews indicate that licensees without prior experience often inquire about an invention to determine if it is of commercial interest to them, normally receive a license in response to the inquiry, and, then upon closer examination of the invention, often conclude they do not wish to pursue it. Licensees with prior experience, on the other hand, tend to screen inventions in their field more carefully before inquiring about them, resulting in a higher proportion of marketing reasons for licensees without prior experience than for those who have it.

Part IV. Effect of Government Patent Policy on Business Competition

a. introduction

Reflecting the government's concern with maintaining a competitive economy, the patent study included tasks to determine whether government patent policy promotes or restricts business competition. Data on this question were gathered from four sources:

(i) Questions on licensing were included in the utilization survey questionnaire to provide a data base for statistical analysis and case studies;

(ii) A pilot study was conducted within the synthetic quartz crystal industry to determine the feasibility of using case studies to explain the effect of patent policy on competition;

(iii) Case studies were conducted on sample patents involved in infringement suits to determine the effect on competition of inventions important enough to involve litigation; and

(iv) Interviews were conducted with patentees who reported inventions unavailable for license to determine the importance of the inventions and their effect on competition.

In evaluating the impact of government patent policy on competition, it is important to distinguish the effects of patent policy from industry particiption in government programs. Competitive advantages in commercial markets may well accrue to government contractors through knowledge gained in new technologies, through sharpening of technical skills, and through government funding of R&D work, which has parallel commercial areas of interest. But these are quite separate from the advantages of owning patents to specific inventions. This study has tried to measure only the latter. And, it has tried to measure it in terms of the inventions included in the survey sample. While a broader study of the cumulative effect of government-sponsored inventions patented over several years might have provided more definitive data, we believe that the study data provides a representative and useful picture of the effects of patent policy on competition.

The study indicates that both in number of inventions utilized and in sales volume, the patents sampled appear to have had small impact on commercial markets. Although over 80 percent of both sample in-

ventions and utilization were concentrated in 50 firms, only 55 inventions owned by contractors—2.7 percent of the sample—played a critical role in their commercial use, and five were responsible for $201 million out of the $406 million in cumulative sales attributable to contractor inventions. This utilization of critical-role contractor-owned inventions is low compared with the total sales of these firms and the industries in which they participate. Of equal importance is the fact that very few instances were reported where owners of government-sponsored inventions refused to license their patents. Only 15 inventions—less than 1 percent of the sample—involved such refusals, and these 15 refusals involved just five companies.

These statistics suggest that government patent policy has a very limited effect on business competition, a conclusion that is corroborated by the case data. None of the infringement suits investigated involved attempts by the patent owner to limit use of the patent to himself. On the contrary, the evidence is that the patent owner, despite a general willingness to license, may find his competitors using the patent first and negotiating a license only when he claims infringement.

The study did show that government retention of title, when coupled with full development and active government promotion of inventions having high commercial potential, has promoted competition. A striking example of this is the fertilizer industry where TVA developed high-concentrate fertilizers, patented them, proved their effectiveness on pilot farms and their commercial feasibility in pilot production, and aggressively promoted their use among farmers and fertilizer manufacturers. Industry sales have increased greatly through the manufacture of these fertilizers by many small regional producers. In circumstances like these, government retention of title can be an effective spur to competition because licenses are available to all comers. But several additional facts must be present for patent policy to have this effect. It must be evident to licensees that the invention has good commercial potential. The invention must be producible in commercial quantities and marketable at a cost that is competitive with alternative product. And the risks of recouping development costs must be no greater than similar investment opportunities available to the licensee.

In most cases, government agencies have to go far beyond discovery of an invention to create these conditions. Some agencies do—as described in the Volume III report on government efforts to promote utilization of government-sponsored inventions. The Department of Agriculture, for example, has an active program of developing inventions to the point of commercial feasibility. Potato flakes and frozen orange juice are two of its well-known successes. That agency, in promoting potato flakes, sponsored pilot production of the product and performed a market study in supermarkets in a major city to determine the product's consumer appeal. The study was then made available to the food industry to stimulate interest in the product.

Notwithstanding the utilization programs employed by government agencies, none except AEC has an express statutory mission to increase business competition in commercial markets for its own sake. When it does occur, however, it is an indirect result of their efforts to accomplish their basic mission. From our observations of the study inventions and insofar as the effect of patent policy is involved, competition does

not appear to have been adversely affected by this lack of direct concent, for three reasons:

(i) The rate of utilization of government inventions has been low.

(ii) The agencies—such as TVA and Agriculture, whose inventions are most likely to be utilized—either developed them in-house or took title to them when developed under contract.

(iii) And industrial owners of government-sponsored inventions have been willing to license them upon request or, where they were unwilling to license, alternative technologies were available to competitors in the great majority of cases.[1]

The sections below present additional findings which support these conclusions. Section B reports on the licensing of survey inventions and Section C discusses the survey patents involved in infringement suits.

B. LICENSING OF INVENTIONS IN THE UTILIZATION SAMPLE

1. Licensing of Sample Inventions

The utilization survey indicated that responding industrial firms held exclusive rights on 1,618 patents in the utilization sample. Ninety-five percent—or 1,539 of the inventions—were reported to be available for license. The sample inventions generated 175 requests for license which resulted in 138 licensing agreements.[2] Industrial firms reported use of inventions by 77 licensees. Only 26 licenses covered inventions also used by the patentee and only eight were critically important in the patentees' use of them.

The small amount of licensing reported by patentees is consistent with the low level of commercial utilization among the survey inventions. The low levels of activity reflect, for the most part, the limited commercial value of most government-sponsored inventions. In comparison, one of TVA's fertilizer patents is used by at least 32 licensees, reflecting both its high commercial potential and the effectiveness of TVA promotional efforts. And, a DOD process patent for growing synthetic quartz is used by every firm in the synthetic quartz crystal industry.

Several utilization trends are apparent from the licensing data: The utilization rate for licenses is 5 percent of the inventions available for license[3]—about half the rate experienced through direct use of survey inventions. Measured against the number of license agreements, utilization is about 56 percent of the total,[4] reflecting the positive interest of licensees in inventions they wish to license.

Table 21 compares major aspects of contractor licensing activity. Although large firms (over $200 million) account for the major share of inventions available for license (79.9 percent), they account for a much smaller share of license requests (56 percent), license agreements (52.2 percent), and licenses in use (46.8 percent). This is due to the

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[1] Except for several case studies which investigated the field of the sample patents involved, studies were not conducted on the effect of a series or cluster of related government-sponsored inventions developed over a period of years.

[2] These agreements were individually negotiated and were not the result of automatic cross-licensing arrangements. No estimates were provided for the extent to which sample inventions were used under cross-licensing agreements.

[3] 1,539 inventions available for license ; 77 licenses in use.

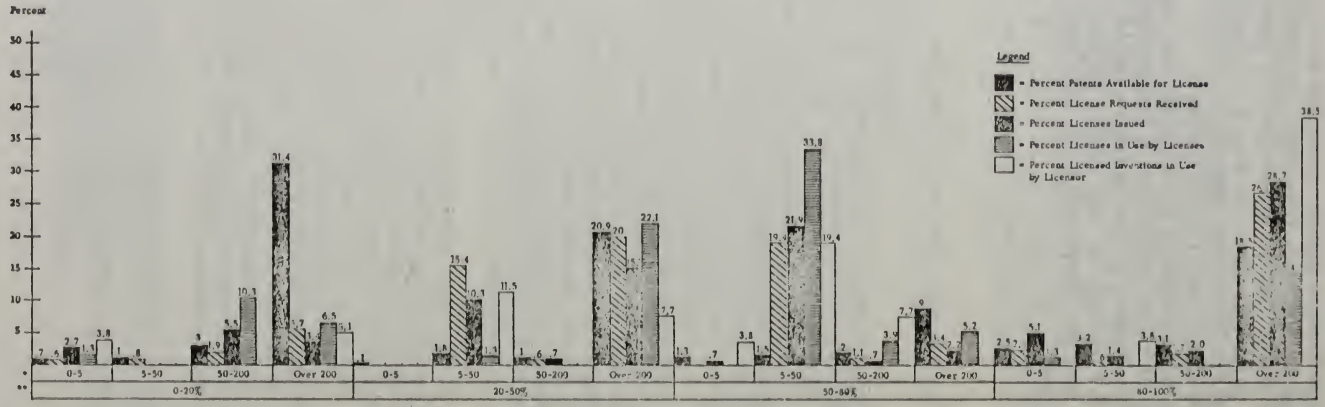
[4] 138 license agreements ; 77 in use.

tendency of large firms to patent inventions more broadly for reasons such as to recognize employee inventions, to protect against infringements suits, to obtain patents with which to negotiate cross licenses in addition to patenting them for direct commercial utilization (see Volume IV, Part II). Thus, large firms have a larger share of inventions with speculative utility than do smaller firms.

This pattern is particularly pronounced for large firms doing 20 percent or less of their business with the government. This group accounts for 31.4 percent of the patents avaiable for license, but it received only 5.7 percent of the license requests, and entered 3.4 percent of the licensing agreements. All that these firms did license, however, were used.

TABLE 21.—Contractor licensing activity by size of firm and percent government business

(Contractor Inventions)



*Size of firm ($ in millions).
**Percent Government business.

Large firms doing 80–100 percent of their business with the government show a contrasting pattern: Accounting for 18.5 percent of the inventions available for license, this group received 26.9 percent of the license requests, entered into 28.7 percent of the licenses, but accounted for only 14.3 percent of the licenses in use. However, 10 of their 11 licenses in use covered inventions which the licensor was also using. Their performance clearly shows a willingness to license even where they use the inventions themselves.

By far the best licensing performance is achieved by firms with sales of $5 to $50 million doing 50 to 80 percent of their business with the government. They account for only 1.5 percent of the inventions available for license, but received 19.4 percent of the license requests, entered into 21.9 percent of the licenses, account for 33.8 percent of the licenses in use, and utilized directly five of the 26 inventions used by licensees. This group—which itself uses only 4.3 percent of the patents in commercial use—made its greatest contribution to utilization through licensing.

A consistent record of utilization both directly and through licenses is shown by large firms doing 20 to 50 percent of their business with the government: Accounting for 20.9 percent of the inventions available for license, they received 20 percent of the license requests, entered into 15.9 percent of the licensing agreements, and accounted for 22.1 percent of the licenses in use. This matches closely their *direct* utilization—27.5 percent of the survey inventions used.

2. Speed in Licensing

Speed in licensing contractor-owned inventions closely matches the speed with which contractors use the inventions themselves. The time lags between applications for patents and the dates of first license, as set forth in Table 22, show that 58 percent of the licensed inventions were licensed within three years of the application for a patent. This compares very favorably with the 68 percent used by patentees within that same period (see Table 16 above).

An even more meaningful test of diligence in licensing is the time it takes to reach agreement once a license request is received. A check of 13 respondents who reported a time lag of one year or more between first commercial use of an invention and issuance of license showed that all but one had issued licenses withon one year of the request. In the latter case—involving a high-speed printer—we found no effort to delay licensing. The initial request was an informal inquiry for information. The requester then decided to purchase printers over the next year. When he did finally request a license, it was quickly granted.

TABLE 22.—TIME LAG BETWEEN PATENT APPLICATION AND FIRST LICENSE AGREEMENT MADE: CONTRACTOR ACTIVITY FOR SAMPLE YEARS 1957 AND 1962

Independent variables	0 to 3 yr	4 to 8 yr	More than 9 yr
Size of firm:			
Less than $5,000,000	5	3	0
$5 to $50,000,000	12	2	0
$50 to $200,000,000	4	1	0
Over $200,000,000	26	23	4
Total	47	29	4
Prior experience:			
Yes	21	6	0
No	26	25	3
Percent government business:			
0 to 20	3	3	0
20 to 50	9	6	0
50 to 80	9	2	0
80 to 100	26	18	4
Field of technology:			
Mechanical	12	8	0
Other	35	21	4
Form of invention:			
Material	3	3	0
Process	1	1	0
Component	21	17	1
End product	22	8	3
Kind of agency:			
Department of Defense	45	27	4
Atomic Energy Commission	0	0	0
Other	2	2	0

3. Refusal to License

The utilization questionnaires were analyzed to determine the frequency and character of refusals to license survey inventions. A high rate of refusals would indicate that industry ownership of patents might have an adverse effect on competition. Initial analyses of the data identified 35 inventions as unavailable for license. All were investigated to determine the reasons for refusal.

Interviews revealed that 20 of the 35 inventions did not really involve refusals to license:

—Nine had either been sold outright or were involved in exclusive license agreements.

—Four were developed by companies which held only a license to the invention from the government.

—Seven involved questionnaires which were answered incorrectly and, consequently, were dropped from this aspect of the study.

The remaining 15 patents, involving five companies, reflected explicit management decisions to withhold licensing as part of their business strategy. (Table 23 lists pertinent information on these inventions.) Licenses were refused for two basic reasons: (i) to establish new markets for the company and (ii) to protect existing markets from competitors. One company, (Company 5), holding 8 of the 15 patents, categorically refused to license competitors when either of the above situations existed. The remaining four companies refused licenses selectively, depending upon their evaluation of the patents and specific market conditions. The first reason—establishment of new markets—was usually associated with specialized new products of limited applicability or with attempts to penetrate markets of well-entrenched competitors. The second reason—protection of existing markets—was a position generally adopted when the company was either competing against industrial giants or attempting to retain its market share through product superiority.

TABLE 23.—REFUSALS TO LICENSE

Invention	Company	Commercial sales	Private development cost	Role of invention	Reason for refusal to license	Sponsoring Government agency
(1) Turbine drive mechanism for miniaturized jet fuel flowmeter.	1	$1,000,000	$450,000	Supporting	Establish market position with new product.	DOD
(2) and (3) Design features and fluid seals for jet fuel flowmeter (2 related inventions).	1	800,000	1,000,000	do	do	DOD
(4) Porous metal and process for manufacture.	1	13,000	300,000	do	do	DOD
(5) Gas turbine motor scroll structure.	2	60,000,000	(1)	Critical	Avoid direct competition.	DOD
(6) Punch guide for microfilm mounting.	3	500,000	30,000	Supporting	do	DOD
(7) Bead breaker for tire mounting machine.	4	66,000	2,000	Critical	do	DOD
(8) Electromagnetic pump for liquid metals.	5	[2] 1,250,000		Supporting	do	DOD
(9) Reagent for carbon dioxide analysis.	5	[2] 11,000	(1)	Critical	do	DOD
(10) Safety helmet with eye shield	5	Neglible	(1)	Supporting	do	DOD
(11) Gas detection techniques	5	(3)	(4)	(4)	do	DOD
(12) Shaft seal for liquid metal pumps.	5	(3)	(4)	(4)	do	DOD
(13) Contaminant analysis for liquid metals.	5	(3)	(4)	(4)	do	DOD
(14) Apparatus to maintain low oxygen atmosphere.	5	(3)	(4)	(4)	do	DOD
(15) Head positioner for helmet	5	(3)	(4)	(4)	do	DOD

[1] Not available.
[2] Commercial and government.
[3] No commercial sales anticipated.
[4] Not applicable.

Nine of the 15 were used commercially (inventions 1 through 9, Table 23). Only three played a critical role in their commercial use. The most successful of these was a gas turbine motor scroll structure (invention 5, Table 23) which was critical to a gas turbine motor involving commercial sales of $60 million to date. The patentee has several active competitors in the gas turbine field and there are alternative ways of performing the function involved in this patent. Given the competitive conditions in this market, the company does not wish to make its design expertise available through license of the patent.

The other two critical inventions involved very modest sales. The first—a device which breaks a tire bead away from the wheel rim on an aircraft landing gear (invention 7, Table 23)—was developed under Navy contract and was an outgrowth of a smaller model which the contractor had invented, patented, and produced for many years. The invention played a critical role in expanding the commercial application of the bead-breaker and was directly responsible for sales of about $66,000. Nominal development costs of $2,000 were required to commercialize the device. Since the device is specialized and has a limited market, the patentee has no interest in encouraging entry of a competitor into the market by licensing the invention. The second—a reagent for analysis of carbon dioxide (invention 9, Table 23)—generated sales of only $11,000, both commercially and to the government.

The six other inventions which were commercially used played supporting roles in their commercial products. Three, relating to various design aspects of jet fuel flow-meters (inventions 1 to 3,

Table 23), represent improvements in a basic patent already owned by the company. The patentee did not wish to license the inventions because it was trying to penetrate a market with a new product. The company invested $1.45 million to commercialize the product, and since 1962 when the invention was first put on the market, commercial sales have been $1.8 million.

This same company owns the fourth invention which played a supporting role—a process for the manufacture of formed metal of uniform density and pore size (invention 4, Table 23). It has been trying to commercialize the invention since 1950 at a cost of $300,000. The company refused a request for license in 1963 because it wished to develop the market from a protected position. But since it has been over five years since receipt of the patent and very little commercial utilization has been achieved—to date, commercial sales have amounted to $13,000—the company expects to turn the invention over to its licensing group for licensing to other manufacturers.

The fifth invention relates to an apparatus for cutting microfilm strips and matting them on aperture cards (invention 6, Table 23), and is part of microfilm processing equipment manufactured by the patentee. The company considers the machine to be highly specialized with only a limited market. Since commercial sales during the past 10 years have only amounted to some $500,000, the company feels quite capable of handling the entire future demand for the equipment and is not interested in licensing competitors. The company has invested some $30,000 in the invention to commercialize it. The sixth invention—a safety helmet with eye shield (invention 10, Table 23)—has had negligible sales.

The last company interviewed showed a somewhat different pattern than the companies discussed above. It refuses to license patents in any new or existing markets in which it is interested. Thus, none of the eight inventions it owns in the sample are available for license. Only three of these (inventions 8, 9, and 10, Table 23, described above) had any commercial sales. The company anticipates no commercial sales of the remaining five patents, which include a shift seal for liquid metal pumps, contaminant liquid metals, an apparatus to maintain low oxygen atmosphere, gas detection techniques, and a head positioner for a helmet.

Table 24 shows the effect of the size of the firm on these refusals to license. Only 1 percent of the inventions of larger firms (over $50 million) were unavailable for licenses compared with 7.6 percent for smaller firms. With respect to utilized inventions, smaller firms again kept a larger percentage for their own use (13.0 percent) than did larger firms (3.8 percent).

TABLE 24.—EFFECT OF SIZE OF FIRM ON REFUSAL TO LICENSE

[In percent]

	License available	License not available
Size of firm:		
Under $50,000,000	92.4	7.6
Over $50,000,000	99.0	1.0
Size of firm where invention is in use:		
Under $50,000,000	87.0	13.0
Over $50,000,000	96.2	3.8

However, the total number of refusals in the survey is negligible, and with the exception of the gas turbine motor scroll structure, none of the inventions described above made any appreciable impact on a commercial market. Even the turbine motor scroll was competing with alternative methods of performing the same function. There is little evidence in the survey inventions that refusals to license have had a material effect on business competition in commercial markets.

C. SAMPLE PATENTS INVOLVED IN LAWSUITS

1. Research Approach

Anticipating that patents involved in court proceedings were likely to be important and have a significant commercial impact, sample patents involved in law suits were investigated to identify inventions which have a significant effect on competition. The purpose, however, was not to study the law suits in themselves, but to determine the effect of the patents on competition.

Working from the listing of contractor-owned patents issued in 1957 and 1962 and from the patent sections of *Shepard's Citations* (including current supplements through July 1967 [5]), we identified patents which had been involved in lawsuits between private parties regarding infringement or validity. The search of *Shepard's Citations* disclosed 16 private suits involving 11 patentees or assignees.

Next, the court files of these lawsuits were examined to determine the nature of the dispute and to decide whether the cases were relevant to the study.[6] In this step, four patents and six suits were eliminated because the main issues did not involve the patents, but were primarily claims for appropriation of trade secrets—one involved use of a patented invention under a government contract rather than commercial utilization. The remaining nine patents involving seven patentees or assignees were selected for further study. In addition, a tenth patent was added during the course of our research. Issued in 1960 to a firm already under study, it had far greater importance than the two related 1957 patents which were the starting point for the research. In each case, interviews were conducted with patentees or assignees to obtain information about the inventions, their commercial development, their licensing and use, and their effect on business competition.

Much of the data provided to us by the companies interviewed were given in confidence. We have, therefore, disguised both the

[5] The patent law requires that when a patent is the subject of a court suit, the Clerk of Courts must notify the Commissioner of Patents, who, in turn, publishes this information in "The Official Gazette." *Shepard's Citation* picks up these listings from "The Patent Gazette" and publishes a complete listing of the patents with citations to the court suits.

[6] No patent was adjudicated in any of these proceedings. While there were some interlocutory opinions and hearings on such matters as change of venue, all the proceedings, expect those still continuing at the date of our research, were settled by the parties through stipulation of settlement, withdrawal, or voluntary dismissal.

inventions and the companies involved and reported them only in summary fashion. For identification, we give the following titles to the cases:

(i) Case 1—The Small Business Case.
(ii) Case 2—The Sophisticated Devices Case.
(iii) Case 3—The Impressive Patent Case.
(iv) Case 4—The Ninety-Percent Government Business Case.
(v) Case 5—The Declining Business Case.
(vi) Case 6—The Commercial Company Case.
(vii) Case 7—The Nonprofit Institution Case.
(viii) Case 8—The Critical Process Patent Case.

2. The Patents Involved in Lawsuits

a. The Small Business Case

The invention involved in "The Small Business Case" is a critical component of a capital equipment item which sells for from $25,000 to $35,000 and which is the primary product of the company. The patentee is an individual inventor—a type who is sometimes thought to no longer exist in this era of group research by large companies—who owns a small business. His company has about 65 employees and has an expected sales volume for fiscal year 1967 of between $700,000 and $1 million, a record for the firm.

The patentee has licensed two domestic firms and the patent is available for license to others. The licenses include a complete transfer of technology. An infringement suit to collect royalties is in process against the largest firm in the industry. There is a widely used alternative technology to the invention and there are other more inexpensive ways of accomplishing its functions that have advantages in some applications.

b. The Sophisticated Devices Case

The invention in "The Sophisticated Devices Case" is a critical component of a specialty device which has its main use on government work, but which also has some sophisticated commercial applications that contribute annual sales of about $200,000 to the patentee. The firm has been trying to promote utilization of the invention commercially, a major factor in deciding to form a small subsidiary company to manufacture it and other less sophisticated devices (amounting to about 80 percent of the commercial market in the total product line) that are in the same product line. The commercial market for the sophisticated device has not yet developed to the extent the patentee expected. The company has licensed three domestic firms to use the invention, including its major competitor.

c. The Impressive Patent Case

The invention in "The Impressive Patent Case" is the most important patent of the ten studied. The invention is basic to a product line line of capital equipment that has total annual industry sales of $22 million to $30 million. About 70 percent of this market is now government, but commercial sales are increasing. No alternative technology to the invention appears available.

The patentee does not manufacture the invention itself, but has entered into an exclusive license with a large diversified manufacturer, who is estimated to account for about 50 percent of the market. The exclusive licensee has negotiated two sublicenses with its major competitors and another two are close to agreement.

The exclusive licensee also manufactures a less spohisticated device in the same general product line covered by another basic government-sponsored patent not included in the sample. The two products compete in the market. Some 10 manufacturers produce the less sophisticated device, one of which has the major share of the market and was the first to sublicense the more sophisticated device.

d. The Ninety-Percent Government Business Case

"The Ninety-Percent Government Business Case" involves three patents owned by a patentee who is among the 50 largest defense contractors and does no commercial work in the field of the patent. Two of these, improvement patents issued in 1957 for which there is a significant amount of alternative technology, are available for licensing and are part of a broad cross-licensing agreement.

The third patent—issued in 1960—is the second most important one studied. It has been basic to important and expensive commercial applications involving sales to date of some $20 million. The patentee has licensed six manufacturers and one user; one manufacturer was included under a borad cross-licensing agreement.

e. The Declining Business Case

The patentee in "The Declining Business Case" has had declining commercial and military sales in the field covered by the two improvement patents involved in the study, even though it owns basic patents in the product line. The company's overall sales have also declined over the last several years.

Although the two improvement patents are available for licensing, there have been no requests from interested firms. The patentee's three basic patents and others in this field, however, have been licensed to its major competitor under a broad cross-licensing agreement. The two improvement patents were issued after the cutoff date of that agreement and were, therefore, excluded from it. An infringement suit is in process in a foreign country to collect royalties on the improvement patents.

f. The Commercial Company Case

The patentee in "The Commercial Company Case" applied its knowledge in a commercial field to develop a device for an entirely different application for the Department of Defense. It then applied the resulting invention—along with some other basic patents it owned—to a system used by one of its major commercial activities. Every competitor in the industry except one uses the patented equipment under license from the patentee.

g. The Nonprofit Institution Case

The patentee in "The Nonprofit Institution Case," is a nonprofit institution connected with a university. The organization does no manufacturing. The invention is critical to a device having modest market potential. When companies began using the invention commercially, the patentee made the decision to collect royalties under license, if possible, rather than dedicate the invention to the public and has licensed the invention to four companies.

h. The Critical Process Patent Case.

The patentee in the "Critical Process Patent Case" does not practice the invention commercially, but has granted an exclusive license

instead. The invention is critical in synthesizing an important mineral used in the electronic industry. The process makes the synthetic mineral produceable at a cost which is competitive with the natural product and, as such, has been instrumental in creating a small, but growing industry. The exclusive licensee is willing to license others, but at a royalty which may make their operations unprofitable. The validity of the patent is currently being tested in a suit involving an infringing user.

3. The Effect of Litigated Patents on Competition

a. General Conclusions

Each situation studied is unique but the general conclusion is that healthy competition exists in all of the cases involving litigated patents. There appears, at first blush, only one situation—"The Impressive Patent Case"—in which there might be enough economic leverage to raise concern over concentration. But even there the total dollar amount of industry sales in an increasing market is relatively small in comparison with the dollar volume of sales in other major industry product lines. As noted previously in "The Impressive Patent Case," five companies occupy the market for the equipment, and the exclusive licensee has at least one half of the market. We believe that the current degree of concentration arose from circumstances other than the fact that patent title was retained by the original R&D contractor:

—The exclusive licensee obtained an early start in the technology. Even before it began negotiations for the exclusive license, it was working on a machine which performed many of the functions of the patented equipment to be used in its own internal manufacturing operations. The exclusive licensee, after receiving its license, completed the first production application of equipment embodying the invention and gained further momentum when it received a substanital government order for the equipment.

—The combination of technological and marketing talents required to produce and market the equipment limited the attractiveness of producing the equipment to a few firms.

—The stated licensing policy of the exclusive licensee is to license all comers on reasonable terms.

—Government business still occupies about 70 percent of the market.

—Improvement patents in the field are held by various compranies.

—The wide market for less sophisticated equipment not covered by the subject patent is part of the competitive environment of the sophisticated equipment because buyers may choose between these two types of equipments for many applications and among the 10 or so manufacturers of the less sophisticated equipment. The exclusive licensee does not have the major share of that market for the less sophisticated device.

In the "Critical Process Patent Case," the invention appears to give the exclusive licensee sufficient leverage to control the industry. We believe it is untypical of government inventions in this respect. But, provision for government "march-in-rights" to require licensing at reasonable rates would appear to provide the necessary safeguard to protect against the occurrence of such cases.

Similarly, the effect on competition of the other cases studied can be summarized as follows:

(i) "*The Small Business Case.*" The activities of the small business in this case have increased competition and lessened concentration within its business area. The company's licenses have involved a full-scale transfer of technology.

(ii) "*The Sophisticated Devices Case.*" The commercial market in this case is small, sophisticated, and, in large part, experimental; and government sales are four times commercial sales. Whereas the patentee has the major share of the government and commercial markets, the potential economic leverage of the invention is small since the patentee has licensed its major competitor and two others at low royalty rates.

(iii) "*The Ninety-Percent Government Business Case.*" The patentee of this invention does not manufacture it and would like to see as many other firms as possible use the invention. Therefore, it has licensed six manufacturers and one user, and would license others. In addition, firms have used the invention rather freely without obtaining a license.

(iv) "*The Declining Business Case.*" Since new companies have been entering this market during the life of the patent and the company's business in the market has declined, it is clear that the patent ownership has not had an adverse effect on competition or concentration.

(v) "*The Commercial Company Case.*" Competition was not adversely affected in this case since the entire industry is licensed and the other commercial patents that the patentee developed were equally basic to the system.

(vi) "*The Nonprofit Institution Case.*" The patentee here does no manufacturing and would like to asee as many companies as possible use the invention. Over the life of the patent, four firms have desired to develop the equipment and have received licenses:

b. Licensing Terms.

Licensing, of course, is a very important factor in the conclusions outlined above. Although many aspects of existing licenses, licensing policies, and royalties were discussed in the research at the various companies, copies of licenses were not available for examination. Much of this information is considered confidential by the companies interviewed.

Some firms did, however, reveal royalty rates, In "The Small Business Case," one license included a 5 percent royalty, based on the net selling price of the equipment. Another l,cense, now inactive, required a 3 percent royalty on manufacturing and sale of the invention and 1 percent on the entire device embodying the invention. Licensees had strong bargaining positions here and were able to negotiate low royalty rates. Another firm stated that royalty rates in its existing licenses are 3 percent to 5 percent and that the method of computing the royalty is based on a customary industry formula. In "The Critical Patent Process Case" a 10 percent royalty is requested by the exclusive licensee and some firms in the industry indicated that such a rate could make their work unprofitable.

Representatives of other firms made more general statements about royalty patterns and rates. In "The Impressive Invention Case," the patentee stated, "we license all comers at reasonable rates." The sublicense agreements are fixed-sum agreements payable over a period of years, and the exclusive licensee pays a certain royalty to the patent owner on each item it manufactures as well as a share of the sublicense royalty payments it receives.

With regard to licensing policy, all firms represented that licenses were available for licensing or—perhaps more realistically—that, "If it comes to our attention that someone is using or wants to use the patent, we will do something about it." This remark appears to reflect industrial patent situations more accurately than the statement that a patent is available for licensing. Often a patent owner is in the frustrating position of having to find out who is infringing on his patent in order to attempt to obtain royalties. This certainly was the case in "The Ninety-Percent Government Business Case" and in "The Nonprofit Institution Case" and "The Small Business Case" as well.

Several factors contribute to this situation. A number of firms take the attitude, "Why not use a patent, as necessary, before negotiating a license, since most patent suits are settled out of court and preliminary injunctions are rarely granted?" and the ideal corporation in which engineers and patent attorneys review all corporate actions for infringement of the patent rights of others does not widely exist. This situation changes the competitive environment from one in which the patentee may limit use of the invention to one in which he may have to aggressively seek out potential infringers.

On the other hand, the tendency to go sailing into infringement situations is certainly not universal. In connection with the two most important patents in our cases, for example, the same large firm was the first to be licensed because it expressed awareness of the patent to the patentee and initiated negotiations for a license. The licensee is widely known to have a patent policy based on deliberate action and advance planning.

Research showed that license negotiations can be very complex. To establish the proper royalty base and to decide what patents are to be included in the license, large companies having numerous divisions or subsidiaries may engage in protracted bargaining. Such bargaining did occur in a number of the selections considered. In one case, delay was encountered in arriving at a proper royalty base and, in another, in working out arrangements suitable for various divisions of the licensee. In a third case, a pending merger of the licensee caused delay. Moreover, in some of the cases, lengthy negotiations were terminated, and resulted in a lawsuit.

c. Extent of Private Development to Commercialize the Inventions.

Four of the cases involved are inventions used in capital equipment sold in both commercial and military markets.[7] In all four of these cases the commercial application of the invention could have been anticipated at the time of invention disclosure. In this respect, these cases run contrary to assumptions often made about commercial use of items developed under military contracts. A fifth case [8] also

[7] "The Small Business Case," "The Impressive Patent Case," "The Declining Business Case," and "The Nonprofit Institution Case."

[8] "The Ninety-Percent Government Business Case."

involves general purpose capital equipment that has wide use in many industries, but the military use is specialized and does not have major commercial possibilities.

One would expect that only a small amount of private investment would be necessary to commercialize an invention whenever it can be used in the same basic configurations for both the government and commercial markets. The small business and declining business firms indicated that this expectation is correct; however, the exclusive licensee in "The Impressive Patent Case" reported that each firm that entered the field spent substantial amounts of private funds to bring the invention to market.

Another way of looking at the question of private investment is to ask, "Would the invention have been commercialized to the same extent once it was patented if the government had retained title?" It appears that in all but "The Sophisticated Devices Case" this would have been so, but this does not answer the question of whether the licensees under those circumstances would promote the invention as aggressively as when they had title. Also, the lack of patent protection may have its greatest adverse effect on small firms; the inventor in "The Small Business Case" would have been in a precarious position if he had not had the protection of the patent and its royalty income to support his entry into a market of much bigger competitors. Based on all observations of the sample inventions, little evidence was found that permitting contractors to retain title to government-sponsored inventions had an adverse effect on business competition.

Part V. Effect of Government Patent Policy on Industry Participation in Government R&D Programs

A. INTRODUCTION

The effect of government patent policy on industry participation in R&D programs was the most difficult factor to measure because of the difficulty of obtaining data on the question. However, a useful understanding of problems in this area was obtained by studying the medicinal chemistry program of the National Institutes of Health (HEW) and various contracts of the Department of the Interior. This aspect of the study attempted to answer such questions as:

(i) Do competent business organizations refuse to undertake government R&D work—either entirely or in selected areas—because of government patent policy?

(ii) What effect does policy have on application of a contractor's most advanced private technology to government programs?

(iii) Does patent policy have any influence on the flow of information concerning new developments between a contractor's government and privately sponsored work?

The data available to us only allows us to define some first-order effects of the policy in this area.

Industry's main concern about participating in government research has been the compromise of private investment in research and invention. Frequent objection was made to the "peephole" effect of government programs, whereby the government receives rights in the accumulated results of private work. The "peephole" effect has its counterpart in patent matters where an invention has been conceived

at private expense, but reduced to practice under a government program. The traditional patent provisions classify this as a government invention and dispose of its rights under the terms of the contract.

The reach of the contract has been extended in some programs to background patents owned by the contractor at the time of contracting. This practice causes the sharpest industry reaction of all because firms feel caught between their wish to participate in government programs and the need to protect their private investment and competitive position.

The major adverse effects of patent policy on participation are program delay, loss of participants, diversion of private funds from government lines of research, and refusal to use government inventions and research when questions regarding a company's propreitary position are raised. These adverse effects occur selectively, but they have occurred at important points in government programs observed in the study.

The key to the participation question, however, lies in the attitude of propospective contractors toward the role of patents in their activities. As noted in connection with utilization, patents have varying importance to organizations doing business with the government. Industrial firms whose major business objective is participation in government work and system-oriented companies in the study sample were at one end of the scale and were found to assign patents a secondary role compared with technical and management competence. Patents typically were used by the former to provide recognition to technical personnel and to project the creative quality of their work to their government customers. Systems firms, on the other hands, were found to rely on patents to ensure design freedom, provide material for cross licensing agreements as well as to recognize creativity in their technical personnel. The data indicates that firms in these two categories are not likely to refuse to participate in government R&D for patent reasons. However, systems firms may encounter participation problems at the subcontract level if the government acquires title to all inventions developed under its program.

On the other hand, firms which place a high value on patents for defensive purposes tend to choose among the areas in which they are willing to undertake government research and may decline to participate in programs which impair their operational flexibility. And, firms in research-intensive industries like electronics and new technically-oriented firms seeking to develop a proprietary product-line through government research were found to rely on patents to establish proprietary positions. These firms tend to be selective in their government-sponsored research and may decline to participate in programs which conflict with their privately sponsored research and development or which do not promote their growth objectives for proprietary lines.

Firms which follow this policy even more fully try to assure corporate ownership of patents before initiating work on a government contract or may consciously isolate government work from their commercial operations. In the latter case, there is usually little interchange of technical innovations between the government and commercial activities of the firm and there may be some loss of relevant technical experience and applications to the government work.

Lastly, large diversified firms often follow different patent policies in different divisions of the organization. Accordingly, they may be willing to participate in government programs with small concern for patents in some areas but with great concern for patent rights in others. It is difficult to generalize about these firms except to notice that their policies tend to follow the patterns of the industries in which their divisions participate. Their behavior may, therefore, resemble any of the categories of firms described above if their divisions have similar business profiles.

With respect to educational and nonprofit institutions refusal to participate for patent reasons is not normally a problem. However, instances were found in Department of Interior programs where patent problems were encountered because of conflicting institutional obligations arising from joint support of a research program or where rights in background patents were sought as a condition of the project. With the rising interest in nonprofit institutions in patents as a source of revenue, greater concern over patent rights can be expected from institutions with large research programs as financial pressures on these organizations continue to increase.

Viewing the participation problem from the standpoint of individual government agencies, the effect of patent policy varies with the nature of their R&D programs and the contractors that participate in them. Participation problems are not a concern to TVA which performs virtually all its research and development itself and, therefore, has little or no contractual interface with industry. They are also minimal in Agriculture programs since that agency contracts almost all its extramural research and development with educational and nonprofit institutions. In addition, the firms that do participate in its programs do relatively little research and development on their own and tend to be less patent conscious than those participating in defense/areospace work.

The direct effect of policy on NSF and HEW programs also appears to be small because most of their contract research is either basic in nature, offering limited opportunities to develop patentable inventions, or is performed by nonprofit institutions who, for the most part, are interested in the research for itself. However, some problems may be encountered in instances of joint or overlapping research at nonprofit institutions where the rights of other parties may be involved. And a significant indirect effect has been noted in an important HEW health program where voluntary noncontractual participation by a patent-sensitive industry was curtailed because of patent considerations.

The Department of Interior, like HEW and NSF, has a number of programs—such as water desalination—which are oriented toward basic research. The Agency contracts in these areas with research-oriented industrial firms (many of whom are patent conscious), as well as educational and nonprofit institutions, and acquires title to patents arising under its programs. Under some programs, statutes on which they are based have been interpreted to require the agency to acquire rights in existing patents owned by contractors because of their relevance to the contract effort and future utilization of contract results. These factors—patent conscious organizations and acquisition of rights to contract inventions and existing patents—have resulted in several instances of hesitation or refusal to participate in the govern-

ment program. Insufficient data was available to establish how widespread the reaction was or its overall effect on Interior programs.

The largest number of opportunities for participation problems occur, of course, in DOD, NASA and AEC programs because of the size and scope of their contract effort. Only a limited amount of data was available on this question for these agenices but a few general observations may be made. At least as to the majority of DOD inventions, to which contractors are normally permitted to retain title, no problem arises. In addition, NASA's policy of waiving title to inventions to promote utilization under appropriate circumstances provides a method for resolving competing government and industry objectives with regard to patents arising under contract. Lastly, interviews with industrial firms in the survey sample indicate that—except where a large investment in related private research, know-how, inventions and/or patents considered to be important in commercial markets exist —acquisition or improvement of technical skills is sufficiently important to them in most cases to justify participating in government programs in their areas of interest even though patent provisions are not completely suitable to them.

However, this does not mean that either a title or license policy will equally serve the government's interests under all the above circumstances, since the policy selected may also affect industrial decisions to use contract inventions commercially. Here again, a balancing of government objectives appears necessary to ensure that the net effect of the patent policy promotes the government's overall goals.

B. EFFECTS OF GOVERNMENT PATENT POLICY ON A MAJOR GOVERNMENT PROGRAM

1. Lack of Collaboration in the National Institutes of Health (NIH) Medicinal Chemistry Program

The NIH medicinal chemistry program was studied by Harbridge House as an example of a major government program in which patent considerations were known to have a noticeable adverse industry-wide affect. Through this study it was possible to define the range of effects patent policy can have when the government either takes title to government-sponsored inventions or reserves the right to do so in programs involving a highly patent-sensitive industry.

The two key factors shaping industry reaction to the medicinal chemistry program are heavy private investment in civilian-oriented research which parallels government work, and application of that research to commercial products in which patents are inportamt in establishing and maintaining a market position. When both these factors are present, patent policy may have a significant effect on participation in government programs and utilization of their patentable research results. A third factor—the extent of invention development by the government for commercial use—will also influence industry reaction even when the other two factors are present since it conditions the financial risks and potential rewards of using an invention without exclusive rights. In this respect, new compounds developed under the medicinal chemistry program are typically far removed from commercial products even when they show useful biological activity, and require substantial additional development beyond the work sponsored by the government. The sections below describe the effects of patent policy on both participation by the

pharmaceutical industry in the medicinal chemistry program and its utilization of program results. Even though industry participation, prior to 1962, was provided at no cost to the government, we believe the effects of patent policy described below would have been the same if the government had attempted to acquire these services from industry under contract.

The NIH conducts extensive work in medicinal chemistry as part of its program in medical and health-related research. Normally 500 to 800 medicinal chemistry grants are in opeation at any given time, and they annually account for about $8 million of the NIH grant program. Under these grants, new compounds believed to have potential medical value are developed; chemical systhesis techniques are studied; the relationship of chemical structure to biological activity is investigated; and research opportunities to promote professional development of medicinal chemists are provided. The typical grant is conducted by personnel associated with universities or hospitals and may cover a period of several years. Frequently, many related compounds are synthesized and tested under a single grant.

Prior to 1962 pharmaceutical firms had routinely made tests for biological activity—at no charge—on compounds developed by grantees. Such screening, required to establish the usefulness of the compounds, is the first step in developing new drugs. According to estimates furnished NIH by the pharmaceutical firms, screening a compound to the point where sufficient data are available to support a Federal Drug Administration application may cost $200,000 to $500,000. Most compounds do not survive the initial broad screening, which may only cost several hundred dollars or less depending on the tests performed.

Since many significant discoveries in medicinal chemistry have occurred by accident rather than by plan, the practice is to screen large numbers of compounds for a wide range of possible uses. The NIH medicinal chemistry program thus provides a fertile source of new and potentially useful compounds for pharamceutical firms to explore. HEW patent policy has required that all rights in inventions arising out of NIH-sponsored research shall be determined by HEW. Prior to 1962, however, drug firms were never required to sign agreements with the grantee of NIH regarding rights to inventions discovered in screening.

In 1962 NIH began requiring pharmaceutical firms to sign a patent agreement before being permitted to screen compounds developed under NIH funds. The agreement imposed four conditions on the screener:

(i) It shall not disclose the results of testing for 12 months, except with the consent of all parties concerned.

(ii) It shall promptly report the results of testing to the investigator and will furnish him the information demonstrating any utility or new use of the compound for use by the PHS in connection with any application for patent that organization may file.

(iii) It shall be permitted to obtain patent rights to new uses of the compounds developed at its own expense *except* under three circumstances:

(a) Where the grantee contributed or participated in the conception of reduction to practice of such new use;

(b) Where the patent would hamper, impede, or infringe on the intended use of the invention;[1]

(c) Where the new use is within the field of research work supported by the grant.

(iv) The government shall receive a nonexclusive, irrevocable, royalty-free license to any new use patent and shall also have the power to sublicense others for all governmental purposes.

The drug firms almost unanimously rejected the amended patent agreement from the beginning for several reasons:

(i) They refused to accept the loss of prospective proprietary rights.

(ii) They feared the contamination[2] of in-house research that would result from taking in compounds arising from NIH-sponsored research.

(iii) They thought that they might lose control over the testing and the reporting of results.

The immediate effect of the drug firms' refusal to sign the amended patent agreement[3] was their almost complete withdrawal from screeing compounds resulting from NIH-sponsored research. However, the overall effects of the policy on the interactions necessary for successful completion of the drug development process are much broader.

The nearly complete blockage of testing—an essential step in the utilization of compounds conceived or developed under NIH sponsorship—is an obvious major effect of HEW patent policy in effect prior to late 1966. The almost total refusal of drug firms to screen (and subsequently develop) these compounds created an insurmountable obstacle to their ultimate utilization, except possibly in those areas (cancer and malaria) where the government operates its own screening services.

What is not so obvious but equally important is the second major effect of patent policy in this area: The crippling limitations on the necessary flow of ideas among the groups that must participate in the drug development process if it is to be successful. This interference occurs even earlier in the drug development process and has even broader impact than the blockage that results from the refusal of the drug firms to screen NIH-sponsored compounds.

2. The Two Major Effects

Before the promulgation in 1962 of the new procedures for HEW patent policy administration, the interplay between the academic community and the drug industry was concrete and specific. A drug firm could actually work, in pursuit of its own interests, with a professor's compound; the professor received, in return, not only the kind of testing appropriate to his specific intentions and test data

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[1] Agreement, as revised in December 1966, eliminates these criteria.

[2] As used by the drug industry and university investigators, "contamination" means the potential compromise of rights in proprietary research resulting from exposure of an individual or organization to ideas, compounds, and/or test results arising from government-sponsored research. For example, a compound developed under NIH-sponsored research comes into drug firm for screening and is found to be useful in a therapeutic area in which the company has conducted prior research; the company incorporates into its research program some of the research findings from the screening of the NIH compound, and the company then develops a marketable product. The company is afraid that HEW is in a position to assert claims to that product. Figures issued by the Pharmaceutical Manufacturers Association show that the drug industry supports the greatest research and development effort per sales dollar (8.7 percent of sales in 1964) of any industry class.

[3] In 1967 approximately 55 agreements were signed by three firms under the revised patent agreement form adopted in December 1966.

sufficient for publication, but also, in many cases, practical suggestions about continuation of his research, new avenues of investigation, and, sometimes, the opportunity to pursue further work under specific industrial research grants. The free pharmacological advice and counsel to which the academic medicinal chemist often had access was of the most practical and experienced type available anywhere. At the same time, the relationship between the academic investigator and the drug firm allowed for recycling—based upon test results—of the research. Positive test results from the drug firm could be incorporated readily into the investigator's research design for further work, and he was almost always assured of the availability of additional testing.

When the drug firms stopped testing compounds conceived or developed under NIH sponsorship, the investigators developing these compounds had to turn to other sources of testing—government, university, and independent testing laboratories. The advantages and disadvantages of these respective sources of testing can be summarized as follows:

Government Testing Laboratories.—Although some attempt may be made by the two government laboratories—Cancer Chemotherapy National Service Center (CCNSC) and Walter Reed Army Institute of Research (WRAIR)—to accommodate the specific intentions of the academic investigator who developed the compound being screened, the high volume of tests usually precludes all but the most standardized screening for activity against the two disease systems, cancer and malaria. For example, although potentially analgesic, antihistaminic, or other compounds may be submitted to CCNSC or to WRAIR for testing on the outside chance that they may show activity (and often merely to allow the academic investigators to publish that the compounds have at least been tested for something), the compounds most likely will not be tested for their intended—and potentially most effective—uses.

University Testing Laboratories.—University-run laboratories have only limited capability to carry out pharmacological evaluation beyond the first gross qualitative steps. In most cases, they have limited access to professional pharmacologists, no experience with FDA requirements and procedures, and little interest in active compounds beyond finding out why they are active.

Independent Testing Laboratories.—Both types of independent testing laboratories—commercial and nonprofit—that evaluate academically prepared compounds must charge for their services so that their testing is self-supporting.[4] Although some of the independent testing laboratories can offer a rather complete line of pharmacological testing capabilities, costs tend to be ybeond the scope of the academic investigators' grant budgets. Representatives of one independent testing laboratory, an organization capable of performing a fairly complete range of services for academic investigators, said that there have been only a handful of tests performed for principal investigators in the 15 or so years of the organization's experience, and that the total value of all of this work would not exceed $10,000. They attributed the low volume to the costs that they had to charge in order to earn a profit from testing. In some cases, nonprofit organiza-

[4] In contrast, testing by a pharmaceutical firm is essentially a by-product of its need for research, testing by government agencies is funded because of important national goals, and testing within universities is squeezed out of operating budgets by interested faculty members.

tions may have grants that allow them to run specific screens; however, this is not true in all medically interesting areas.

It does not seem to matter much which screening source other than drug firms is used to test the NIH-sponsored compounds—the result is the same (except in the case of a compound that proves useful in treating cancer or malaria.)[5] Having to do without the drug firms' screening services—which in their total range include specific screening, extensive test results, and concomitant development work—means to the academic investigator that the work on his compound that is necessary for ultimate utilization is cut off, in most cases, at the development state.

The second major effect of current government patent policy is the serious weakening of the communications links vital for the productive interchange of research ideas. Prior to 1962, the interchange of ideas among the NIH, university investigators, professional journals, and drug firms was accomplished through consulting relationships, work on compounds, test data, and papers. Since 1962, two of these media for interchange of ideas—the flow of compounds and investigators—have been virtually eliminated. The other two media—consulting relationships and papers—have been diluted by the lack of drug industry screening services for NIH-sponsored compounds. Drug firms currently seem to screen their consultants carefully; a criterion for an acceptable consultant seems to be noninvolvement with government research related to the drug firm's interests. With regard to papers, the lack of extensive—or even, in many cases, specific—test results has led to decreased publication of results of medicinal chemistry research. In addition, two media contacts through scientific seminars and personal friendships have been affected to some extent.

In summary, many extremely important contacts among academic, industrial, and government researchers in areas outside of cancer and malaria have been either eliminated or seriously decreased because of the current patent policy and the consequent threat of "contamination" of industrial research. In contrast, when the compound originates under a drug industry grant, the working relationship between the academic investigator and the drug firm screening his compound is very close, and research can be recycled or replanned as necessary to meet specific goals.

From their respective testing services outlined above, the roles and operating patterns of the various screening sources can be summarized as follows. The pharmacology department of a drug firm acts as a sort of sophisticated broker between an inventory of tens of thousands of compounds (some generated by academic investigators and some generated through in-house efforts) and the clinical requirements of the medical profession. Since it is specifically oriented to cancer and malaria, the pharmacology work done by CCNSC and WRAIR also falls in this category. The pharmacology department of a university probably functions more as a scientific knowledge-gathering organiza-

[5] Because of the large amounts of money available for cancer research and malaria research, the availability of testing facilities in these fields, and the fact that compounds in these fields seem to have the greatest chance for utilization, cancer research and malaria research are attracting great interest and effort on the part of university investigators in medicinal chemistry. Compounds found, through government screening, to be useful in treating cancer or malaria are developed by the government and can be carried through the remainder of the drug development process to the consumer.

tion operating with an inventory of compounds and producing state-of-the-art studies. Commercial testing organizations are less broadly focused than either the pharmacology department of a drug firm or the pharmacology department of a university. The operations of a nonprofit testing organization can resemble the operations of any of the other screening sources, depending on the specific circumstances of the nonprofit organization.

With regard to the second effect of patent policy—the limitation on productive interchange of research ideas—practically every scientist interviewed in this study was worried about the comparative isolation of academic and government investigators from their drug industry counterparts. Vital communications links have been weakened in large measure by the problem of "contamination." Drug firms are negative about government patent policy not so much because they may lose rights to the outside compounds that they test, but because the outside compounds, any related in-house items that they may already have, and any and all ideas submitted to them by academic investigators may become the subject of a claim of rights by the Surgeon General. Consequently, drug firms are quite concerned about keeping all ideas that may have come from NIH-sponsored research segregated from their own research. To accomplish this segregation, they have minimized those professional contacts and meetings that could later be construed as having contributed to their own research.

The issue of contamination of ideas arises with regard to several other sources of ideas in addition to the NIH idea itself. Was the research that the journal article described performed under an NIH grant? Did the colleague communicate ideas developed under NIH sponsorship? Because of the investigator's intimate knowledge of NIH-projects, can virtually anything he does be considered contaminated? The implications of these questions are worrying the drug industry.

The implications of government patent policy do not end with the proposal preparation phase—the typical investigator is continually confronted with patent questions while pursuing his projects. For example, consider the case of an investigator with an industry-sponsored project, a foundation-sponsored project, and an NIH-sponsored project. He reads professional literature, attends meetings, and keeps up his contacts in his search for new ideas and approaches. In addition, his own analysis and experimentation on each project yield data that may have application to his other projects and to projects of his professional associates within his organization. He must continually live with the question of the extent to which he must recognize proprietary and government patent rights—and with the adverse effects that appropriate recognition of these rights necessarily has upon what would otherwise be relatively free research communications. For the diligent respecter of rights, current government patent policy tends to inhibit contacts among associates and the concomitant idea flow between projects and to prevent the results of work sponsored by NIH from being used in further drug research.

Evidence that the effects observed in the medicinal chemistry program were not just an isolated occurrence in one industry was found in cases relating to development of two biomedical inventions. In both instances, companies with investments in private research and portfolios of background patents to products similar to those the government was proposing to develop, hesitated to deal with NIH if they had to forgo title to inventions developed under government contract or give up rights to related background patents. Similar experiences were encountered in Department of Interior programs, as reported in Volume II of the study. Although there was insufficient data to determine how broadly government programs are affected by nonparticipation of industry for patent reasons, it seems clear that some programs are. To deal with these problems as they surface, it may be desirable to establish a procedure that provides for reexamination of their treatment under the policy when a government agency finds that the policy is materially affecting accomplishment of a program.

REPORT AND RECOMMENDATIONS ON GOVERNMENT PATENT POLICY OF THE COMMITTEE ON GOVERNMENT PATENT POLICY OF THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

1968

This report is an evaluation made by the Federal Council for Science and Technology's Government Patent Policy Committee of the results and conclusions of the Harbridge House Study (printed in the present report beginning at p. 69) and their application to the Presidential Patent Policy Statement.

REPORT AND RECOMMENDATIONS ON GOVERNMENT PATENT POLICY OF THE COMMITTEE ON GOVERNMENT PATENT POLICY OF THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

1968

Summary

In December of 1965, the Federal Council for Science and Technology established the Commitee on Government Patent Policy for the purpose of assessing how the Presidential Memorandum and Statement of Government Patent Policy had worked in practice, and to acquire and analyze additional information that would contribute to the reaffirmation or modification of the Policy, and to the identification of principles underlying sound legislation. In undertaking this assignment, the Committee contracted with Harbridge House, Inc. of Boston, Massachusetts, to collect and analyze as much information and data as possible which would provide a better understanding of the effects of alternate patent policies on (1) achieving expeditious development and civilian utilization of government-financed inventions, (2) obtaining the cooperation of industry in assisting the Government in its research and development efforts, and (3) competition in commercial markets.

The contract effort was divided into two general phases. The first was the collection and analysis of all available information and data regarding the circumstances surrounding the commercial utilization, or failure to utilize, a large sample of patented invention derived from government sponsorship. In the second phase, the contractor conducted in-depth studies on selected cases, primarily for the purpose of obtaining a better understanding and assessing the accuracy of the data to be gathered under the first phase. Through this study effort, Harbridge House obtained the basic data on more than 2,000 government-sponsored patents, and conducted over 200 in-depth studies of specific inventions, government contractors, and contracting situations to assess the effects of government patent policy.

In general, the Committee finds that the study results provide no basis for changing the basic principles of the Presidential Policy, although they do indicate a few areas where modification in the criteria would be appropriate. In particular, the study confirms the statement in the Presidential Policy that ". . . a single presumption of ownership does not provide a satisfactory basis for governmentwide policy on the allocation of rights to inventions."

Throughout the study effort, the identification of factors that might be found surrounding an invention or a contracting situation which affect the utilization, participation, and competition issues, demon-

strated that a single "title" or "license" policy would not be in the public interest, whether applied to a government-wide policy or to the policy of any particular agency. The study results indicated that to increase participation and utilization, government patent policy must accommodate itself to factors other than patent rights that have a great influence on these goals—for example, the market potential of an invention, the organizational and commercial structure of government contractors, the development and promotional activities of the government agencies, and the state of development of the invention. By taking these factors into consideration, the data suggests that the allocation of patent rights can have an influence on the three policy objectives.

The Committee concludes that rights to inventions made under government contracts, where not otherwise required by statute, should be allocated in accorcance with a flexible, government-wide policy which follows the basic principles and critieria of the October 1963 Presidential Policy Statement. This conclusion is based on the fact that:

(1) The Presidential Policy was based on years of actual operating experience under various policy criteria;

(2) Experience under the Policy to date indicates that it has been effective in bringing about a greater degree of consistency in the patent policies and practices of the agencies, and has provided a greater degree of protection of the public interest; and

(3) The Harbridge House study results and the operating experience of the government agencies indicate that the principles underlying the Presidential Policy, and, with minor exceptions, the criteria established by this Policy for allocating patent rights—

Take into consideration the several factors found to influence utilization of invention, participation by industry, and commercial competition in a manner which balances the overall interests of the public.

Provides the necessary operational flexibility needed by the agencies to accomplish the objectives of their missions under differing contractual circumstances, and

Within the differing mission constraints of the federal agencies, promotes consistent application of patent policies and practices in similar contracting situations.

In view of these conclusions, the Committee recommends the continuation of a flexible, government-wide patent policy following the basic principles and criteria of the October 1963 Presidential Policy Statement. Specifically, the Committee recommends the continuation of such a policy either by making minor modifications to the Presidential Policy (which would be subject to present statutory requirements), or by proposing legislation based on similar principles and criteria which would be applicable to all agencies.

Part I—Background

A. Establishment of the Committee on Government Patent Policy

The Presidential Memorandum and Statement of Government Patent Policy (Appendix 1) was formulated carefully after eighteen months of interagency discussions and consultations, and brought

together the experience and views of twenty federal departments and agencies on the issues involved in allocating rights to inventions between the Government and its research and development contractors. Although this Presidential Policy was not viewed as the ultimate answer to this long discussed question of national policy, it was viewed, on the basis of the knowledge and experience then available, as the first attempt to establish a central rationale, within existing legislative constraints, for the allocations of such rights in a manner deemed best to serve the public interest. Recognizing that actual experience under, and additional study of, the Policy could indicate the need for modification or further implementation, the memorandum accompanying the Policy Statement provided for a continuing evaluation and for a review of the Policy after a reasonable period of trial, and in the light of the facts and experience accumulated.

In light of continued Congressional and public concern over the patent policy issue, the Federal Council decided that a concentrated effort should be made to study in greater depth the principles underlying the Presidential Policy. To perform this function, the Federal Council established in December of 1965 the Committee on Government Patent Policy. Specifically, the Committee was requested to assess how the Presidential Policy had worked in practice, and to acquire and analyze additional information that would contribute to the reffirmation or modification of the policy and to proposing principles underlying sound legislation.

B. STUDY APPROACH

In fulfilling its assignment, the Committee first identified three questions which the members believed to be basic to the government patent policy issue, and to which answers would be desirable in analyzing government patent policy. These three basic questions centered on the effect that alternative patent policies would have on:

(1) Achieving expeditious development and civilian utilization of government financed inventions;

(2) Obtaining the cooperation of industry in assisting the Government in its research and development efforts; and

(2) Competition in commercial markets.

After considering various approaches to obtaining information and data necessary to shed light on these basic questions, the Committee decided to contract for a study effort for the collection and analysis of data which would increase the base of knowledge of the effects of government patent policy on the public interest. In the belief that prior studies, published articles, and Congressional hearings more than adequately identified the philosophy, opinions, and positions of all segments of Government and industry, the Committee decided to direct the contract study as much as possible toward the accumulation and analysis of factual information. Accordingly, it was decicded to begin the study by concentrating, at least initially, on issued patents resulting from government-sponsored research. Afterwards, the study effort could work back from this known information source to determine what additional information could be collected that might assist in evaluating government patent policy in general, and the Presidential Policy in particular.

The Committee believed that the results of such a study effort, together with the many years of operating experience of the federal

departments and agencies under various patent policies established by the agencies, by statute, and more recently by the Presidential Policy, would provide the information base needed to make recommendations to the Federal Council. After deciding on this study approach, the Committee selected Harbridge House, Inc. of Boston, Massachusetts to conduct this study effort.

C. DESCRIPTION OF THE STUDY CONTRACT

The contract effort was divided into two basic phases. First was the collection and analysis of all available information and data regarding the circumstances surrounding the commercial utilization, or failure to utilize, patented inventions derived from government-contracted research and development. And second, the contract provided for conducting in-depth studies on selected cases involving the effect of government patent policy. The second phase was primarily for the purpose of obtaining a better understanding, and for assessing the accuracy of the data to be gathered under the first phase.

In order to conduct the first phase of the study, two years were selected, 1957 and 1962, and the government register of the U.S. Patent Office was consulted to identify every U.S. patent which issued in these two years which resulted from work performed by contractors under government financing. These patents formed the sample of government-sponsored inventions which was the data base for the first phase. The patents issuing in two years, spaced apart by several years, were selected to obtain a more representative sample than might be obtained from a single year. The two specific years of 1957 and 1962 were selected to permit a reasonable length of time for the patents to have been commercially used and to have had any identifiable effect on their relevant commercial markets. Although the Presidential Policy was not in effect during either of the selected years, the agencies' patent policies then in force were sufficiently diverse to permit a full range of conditions between the license and title policies.

Approximately 3600 patents issuing in these two years were identified as resulting from government-contracted research and development efforts of approximately 450 different organizations, including industrial firms, nonprofit organizations and universities. However, in view of the fact that relatively few of these patents were from agencies other than the Department of Defense and the Atomic Energy Commission, it was decided to increase the patent sample for the public-oriented agencies.[1] From a patent policy point of view, the research results of these public-oriented agencies were more important than the small number of patents would indicate. Accordingly, the patents for these agencies were increased by including all contractor-developed patents issuing in the years 1956 through 1966. In this manner, the effect of patent policies on the research results of these agencies could be determined more adequately.

[1] Harbridge House classified the Federal agencies into three categories: (a) public-service or public-oriented agencies which conduct R. & D. programs to benefit the public directly, as Agriculture, TVA, Interior and HEW; (b) mission-oriented agencies which conduct R. & D. programs for the agency's own internal use, as DOD; and (c) agencies with mixed R. & D. activities, as AEC and FAA.

The Committee realized that obtaining accurate information on the circumstances surrounding commercial utilization, or on the failure to utilize these inventions would be difficult, even for contractors with exclusive commercial rights to the inventions involved. It was concluded, however, that all available information should be obtained and it was decided to collect this information from the contractors through questionnaires. At the same time, it was recognized that the same type of information could not be obtained as accurately for those inventions owned by the Government, particularly in view of the general policy of government agencies to not actively attempt to prohibit commercial use of its inventions without permission of license. Several instances of this type of use were known; but little information was available on the extent of such unlicensed use. Nevertheless, the Committee decided that an attempt should be made to obtain as much information on these patents as possible through questionnaires being sent to those believed most likely to use the inventions—that is, the inventing contractors and firms which had specifically requested licenses from the Government.

Two questionnaires (Appendix 2) were designed jointly by the Committee and Harbridge House to ascertain information concerning the type of contractor, contract, government agency, and invention involved. The questionnaries were also intended to determine the various relationships among these factors of the type which play an important role under the principles established by the Presidential Policy, and of the type brought out in the public discussions that have revolved around this issue throughout the years. One questionnaire was sent to the government contractors which made the inventions issuing as patents during the two sample years, whether the contractor acquired title or merely retained a license, and the other was sent to licensees (other than the inventing contractor) of government-owned patents issued in the two sample years, whether the patents resulted from contract or in-house research efforts.

The first phase of the contract study, therefore, was for the purpose of obtaining from a large sample of government-financed patents, limited factual information concerning the patented inventions and their commercial use. An analysis of this factual information was intented to identify relationships among the many factors involved in the patent policy issue which might provide a better understanding of the three main policy questions. On the other hand, the second phase of the contract effort was to study, in depth, a smaller number of selected case examples to obtain a more thorough understanding of the interactions among the relevant factors in different types of factual situations, and to use the results of the studies to assist in analyzing and evaluating the bulk factual data collected through the questionnaires. The following types of in-depth studies were conducted:

(1) Studies of the industrial firms having the highest and lowest rates of utilization of the patents in the sample;

(2) A cross-section of educational and nonprofit institutions to determine their patent activities and promotional efforts;

(3) Several patented inventions developed under the research sponsored by the public-oriented agencies to determine the effect of their public orientation and promotional activities;

(4) Previously known instances within Interior and HEW of problems arising in the contracting process because of patent policies;

(5) An industry-wide study of the cooperative efforts between the university community and the pharmaceutical industry in developing the results of NIH-sponsored research grants;

(6) A study of all reported instances where contractors which owned title to the patents had refused to license others; and

(7) Each instance where patent infringement suits were initiated for infringement by third parties of patents owned by government contractors.

In addition to these, Harbridge House followed up on the responses to the questionnaires where the information appeared to be particularly relevant; for example, in each case where the questionnaire response indicated that the invention played a dominant role or where the sales of the invention were indicated as being over $1 million. Also, some followup was conducted on a large number of those firms which did not respond to the questionnaire.

Part II—Results of the Harbridge House Study

Under the study contract, Harbridge House was requested to collect and analyze relevant data concerning the effect of alternative government patent policies on the three main policy issues; that is, on the commercial utilization of government-sponsored inventions, on the participation of industry in the Government's R&D programs, and on commercial competition. However, the contractor was specifically requested not to make overall policy recommendations, as the Committee membership believed that the Committee itself should be responsible for formulating the ultimate recommendations on government patent policy, based not only on the results of the Harbridge House contract, but also on the years of operating experience of the government agencies, and on other practical considerations of government operations. Also, it was believed that the agency members on the Committee would be in the best position to recommend "trade-offs" between the utilization, participation, and competition issues which would be necessary in formulating such a policy.

Accordingly, Harbridge House collected and analyzed the data under the study contract and applied the results to each of the three main policy issues separately. This analysis is set forth in the "Summary and Analysis of Findings" section of Volume I of the Final Report to the Committee, and is included in this report as Appendix 3. The following sections of this part discuss in greater detail the results of the study effort.

A. Questionnaire sample and response

Table 1 sets forth the number of patents made by government contractors which were identified as a result of the selection process discussed in Part I, identifying the distribution of rights between the Government and its contractors.

Questionnaires were sent to the inventing contractor where the contractor had either exclusive or nonexclusive rights to the patent. Approximately 200 patents were eliminated from the sample because

similar information had been requested through previous studies, the type of contractor or the rights held by the Government were such that there was no opportunity for utilization by the contractor, or because the inventing contractor could not be found or was a foreign corporation. Approximately 3,400 questionnaires were sent to 463 inventing contractors of the patents in the two sample years.

TABLE 1.—DISTRIBUTION OF SAMPLE PATENTS MADE BY CONTRACTORS

Patent rights	1957	1962	Supplemental patents [1]	Total	Percent
Title in the contractor	1,003	1,621	72	2,696	73
License in the contractor	419	411	17	847	22
All rights in the government (AEC)	51	95		146	4
Total	1,473	2,127	89	3,689	10

[1] The supplemental patents are those identified for some public-oriented agencies issued during the years 1956, 1958 through 1961, and 1963 through 1966, in order to obtain a more significant sample of patents for these agencies.

In addition, a similar questionnaire was sent to every firm, other than the inventing contractor, which had requested and received a license from the Government under government-owned patents issuing in the years 1957 and 1962, regardless of whether the invention was made under contracted or inhouse research activities. These questionnaires were sent to 342 licensees of 126 inventions.

The questionnaire information classified the contractors by categories of size (in millions of dollars of annual sales) and percentage of government business. Tables 2 and 3 show the number of industrial contractors responding to the questionnaires concerning the patents issuing in 1957 and 1962 by these two categories. A majority of the firms which did not respond to the questionnaires held only one or two patents each, and a few firms held a large number of patents. For example, of the firms which did not respond to the questionnaire, the five largest firms (rated by the number of patents held in the sample) accounted for approximately forty percent of the patents for which no response was received. Of the approximately 3400 questionnaires that were sent to 463 inventing contractors of the patents in the two year sample, a response was received for 2024 of the patents from 192 firms.[2] In addition, 149 responses were received from the 342 licensees of the government-owned inventions.

TABLE 2.—NUMBER OF RESPONDING CONTRACTORS BY PERCENT OF GOVERNMENT BUSINESS [1]

Percent government business	1957	1962
0 to 20	41	62
20 to 50	20	15
50 to 80	12	19
80 to 100	30	35
Total [2]	103	131

[1] Nonprofit and educational institutions are not included in tables 2 and 3 because these contractors could not classify themselves by percent of government business and dollars of sales.
[2] The total number of contractors responding to the questionnaires, including both sample years, was 192.

[3] Ninety-five percent of this response involved inventions developed under DOD sponsorship.

TABLE 3.—NUMBER OF RESPONDING CONTRACTORS BY SIZE [1]

Annual sales (millions)	1957	1962
0 to 5	21	19
5 to 50	29	35
50 to 200	19	24
Over 200	34	53
Total [2]	103	131

[1] Nonprofit and educational institutions are not included in tables 2 and 3 because these contractors could not classify themselves by percent of government business and dollars of sales.
[2] The total number of contractors responding to the questionnaires, including both sample years, was 192.

B. ANALYSIS OF QUESTIONNAIRE DATA [3]

The data received from the questionnaire responses for the patents in the two sample years of 1957 and 1962 were processed and analyzed in categories separating types of contractors and third party licensees of government-owned patents. The three following categories were used:

(1) Contractor inventions made by profit-making organizations;

(2) Contractor inventions made by educational and nonprofit institutions; and

(3) Government-owned inventions made by both government employees and contractors which were licensed to parties other than the inventing contractor.

1. Summary of Commercial Utilization

The responses for the 2024 patents issued in the two sample years from government contractors indicated that 251 of the inventions (12.5 percent) achieved commercial utilization.[4] More specifically, they reported:

(1) Two hundred inventions were utilized by industrial contractors who owned title to all but seven of the patents, and twenty-six of these inventions were utilized by licensees of the contractors as well;

(2) An additional fifty-one inventions not utilized directly by contractors were utilized by their licensees, ten of these inventions being owned by educational or nonprofit institutions; and

(3) Fifty-five of the utilized inventions (2.7 percent of the 2024) played a critical role in the commercial products in which they were used.

Of the questionnaires forwarded to third party licensees of government-owned inventions patented in the two sample years, the responses on 126 inventions indicated that ten of these inventions were in use by some fifty licensees.[5]

[3] The supplemental patents are not included in the analyses of the data in this section. The supplemental patents were used primarily for the purpose of identifying cases for in-depth study of commercial utilization of inventions from the public-oriented agencies.
[4] For the purpose of this study, only utilization by contractors and licensees of Government-sponsored inventions in commercial markets was considered. No attempt was made to measure utilization of inventions by the Government. In view of the fact that the vast majority of the patented inventions included in the 2-year sample resulted from research directed toward governmental or military applications, the use being measured can be considered primarily as "spin-off" use of the results of the Government's R. & D. efforts.
[5] Although the Harbridge House report did not specify the number of responses received on the 89 supplemental patents, five of these patented inventions were reported as being used commercially.

The data indicated that both the patent holdings and the utilization of the inventions on which responses were received were heavily concentrated in a few contractors. For example, the top five contractors (ranked by order of the number of questionnaires in the response) accounted for 31 percent of the patents held by the responding contractors, 33 percent of the responses received and 27 percent of the patents which were utilized. If the top 25 of the 192 contractors are considered, the data shows that these firms accounted for 71 percent of the patents held by the responding contractors, 73 percent of the responses received, and 68 percent of the inventions utilized. Tables 4 and 5 categorize the responding industrial contractors according to the percent of the patents held by the responding contractors, the percent of the responses received, and the percent of the patents utilized, according to their percent of government business and their size.

TABLE 4.—DISTRIBUTION OF RESPONDING CONTRACTORS BY PERCENT OF GOVERNMENT BUSINESS

[In percent]

Government business	Patent holdings	Response	Utilization
0 to 20	41.0	43.5	29
20 to 50	23.5	14.0	32
50 to 80	11.0	11.0	18
80 to 100	24.5	31.5	21

TABLE 5.—DISTRIBUTION OF RESPONDING CONTRACTORS BY SIZE

Annual sales (millions)	Patent holdings	Response	Utilization
Less than 5	3.2	18.5	4.5
5 to 50	8.1	26.5	13.0
50 to 200	8.4	19.5	10.0
Over 200	80.3	35.5	72.5

2. Factors Affecting Utilization

Harbridge House concluded, primarily from the various case studies which were conducted, that the most important factors influencing the utilization of the results of government-financed research are not those directly related to the patentability of the results, nor to the rights a firm may have in an invention. Paramount, of course, is the applicability of an invention to the commercial market. Also of great importance are such factors as the size of the potential market and the amount of risk capital that will be necessary to market the invention. Recognizing the greater influence of these factors, the questionnaire data were analyzed to identify any areas where the appropriate application of patent policy might also influence the commercial adoption and utilization of government-financed inventions.

a. Prior Experience

The questionnaire data showed a marked correlation between prior commercial experience and commercial utilization. Utilization of the inventions in the two sample years by the inventing contractors was 23.8 percent when the contractor had title to the patent and prior commercial experience. However, when the contractor had no prior commercial experience, utilization dropped to 6.6 percent even

though the contractor had exclusive rights to the patent. Considering commercial utilization of government-owned inventions by firms other than the inventing contractor, prior commercial experience also had a considerable effect. The data indicated that licensees of these patents reported a utilization rate of 62 percent when they had prior commercial experience, but the utilization rate dropped to approximately 20 percent when there was no prior experience.

b. Exclusive Rights

The reported data also showed a correlation between commercial utilization of inventions by government contractors and the availability of exclusive patent rights. As stated above, when the contractor had both title to the invention as well as prior commercial experience, the utilization rate was 23.8 percent. However, the utilization rate dropped to 13.3 percent where the contractor still had prior experience, but did not have exclusive rights to the invention. It should be noted, however, that the majority of these inventions were developed under agency policies which gave the contractor the first option to acquire title to the invention. Therefore, a contractor's decision not to acquire title to an invention would have been influenced, at least in part, on the contractor's appraisal of the invention in market potential.

c. Size and Percent of Government Business

In general, contractors having a lower percentage of government business reported a higher utilization rate than those firms which were more government oriented. Harbridge House attributed this to the fact that these firms, being more oriented to commercial markets, had the necessary experience and market outlets to enable them to utilize the invention in their commercial product lines.

Also, smaller firms generally reported a higher utilization rate than the larger firms. Harbridge House believed that this was due, at least in part, to the function of selectivity in patenting, as larger firms have a tendency to patent inventions for reasons other than anticipated use. For example, larger firms stated that they make greater use of patents as a means for recognizing the accomplishments of technical and scientific personnel, to insure flexibility of design, and for defensive and cross licensing purposes.

d. State of Development

The questionnaire data, as well as the in-depth studies, indicated generally that the inventions resulting from the R&D activities of the mission-oriented agencies, as DOD, often did not have any commerical applicability, and when the inventions did have a commerical use, a considerable amount of additional technical development was often necessary in order to market these inventions. Conversely, the data and studies indicated that the inventions resulting from the R&D efforts of some of the public-oriented agencies, as TVA and Agriculture, were more often directed to particular commercial needs and developed to a point where little or no additional technical development was necessary to commercialize inventions.

e. Reasons for Non-Utilization

The questionnaires forwarded to inventing contractors and licensees of government-owned patents requested the responders to rank, in the

order of importance, several marketing and technical reasons which explained why the inventions were not utilized.[6] The responses from both the inventing contractors and the licensees of government-owned patents reported marketing reasons predominantly for failure to utilize an invention. The replies from government contractors (predominantly DOD inventions) gave marketing reasons for not using the inventions 1305 times for the most important reason, and 1919 times within the first three reasons ranked in order of importance. This is in contrast to technical reasons being ranked first in importance 47 times and 196 times ranked in the first three reasons.

Responses from the licensees of the government-owned patents gave a much higher importance to technical reasons for not using the invention, even though the marketing reasons were still predominant. The licensees listed the marketing reasons 37 times as the most important reason and 65 times within the first three reasons. Technical reasons were listed 25 times and 38 times as the first and first three reasons for non-use, respectively.

Technical reasons for the inventions not being used were substantially more frequent for the government-owned inventions produced by the public-oriented agencies than for the mission-oriented agencies. For example, "no commercial potential was seen" for the invention was given in 29% of the responses for the most important reason by government contractors, as contrasted with this reason being ranked most important in only 3% of the responses for the government-owned patents.

3. Commercial Sales and Private Development Costs [7]

The foreign and domestic commercial sales of products utilizing the inventions in the two sample years were reported by the inventing contractors as amounting to $406 million to the date of the survey. All but $271,000 of these sales were attributable to inventions arising from DOD contracts. Five of the 200 inventions on which these sales were based accounted for approximately 88% of the sales in this group, and the remaining 44 critically important inventions accounted for $29 million in sales. Approximately $26 million was reported as being necessary to commercialize the inventions for which sales data was available.

In relating the commercial sales of these inventions to the contractors that held the greatest number of patents in the response, it was reported that not one of the top ten patent owners had a sample invention with cumulative sales of more than $2 million, even though these top ten contractors held 52% of the patents in the response and accounted for 44% of those inventions utilized.

On the other hand, the data showed that the ten government-owned patents which were utilized accounted for commercial sales of $210 million, approximately $197 million was attributable to Agriculture

[6] The marketing reasons included: invention became obsolete; expected market failed to materialize; technology too sophisticated; too much competition, channels of distribution lacking; invention falls outside company product lines; and no commercial potential seen. The technical reasons included: development costs to high; development revealed serious flaws; and development personnel not available.

[7] Harbridge House conducted interviews with all respondents who reported inventions with sales of more than $1 million to verify the sales estimates. When an invention did not contribute significantly to the sales of a product, there were excluded from this analysis.

inventions, and only $75,000 of which were the result of inventions arising from DOD research. The using licensees of these ten government-owned patents reported that a little over $5 million was necessary to commercialize these inventions.

4. Time Lag to Commercial Utilization

The questionnaire data indicated that, of those inventions which achieved commercial utilization, approximately one-third were used prior to the time that a patent application was filed, and another one-third were used within the three year period after the patent application was filed.

As would be expected, the data showed that those contractors which had prior commercial experience in the area of the invention achieved commercial utilization of their inventions more quickly than did those contractors which had no prior experience.

It was also found that the contractors with up to 20% government business and those within a range of 80% to 100% did not achieve commercial utilization of their inventions as fast as did those firms in the middle range of government business. Harbridge House attributed the slower utilization of inventions by the firms with both high and low proportions of government business to the fact that the study indicated that these firms separated their government and commercial work to a greater extent than did firms in the medium ranges of government activity.

5. Licensing of inventions

Government contractors reported that only 15, or less than 1 percent, of the 1,618 patents which the contractors owned were unavailable for licensing to other firms. The contractors who owned these inventions received 175 requests for licenses, which resulted in 138 license agreements,[8] of which 77 were reported as being in use. In addition, the data show that licensing of the contractor-owned patents occurred quickly, with 58 percent being licensed within three years after a patent application was filed by the contractor. Of the 138 license agreements entered into by contractors, 77, or approximately 56 percent, were used by the licensees.

The 149 licensees of government-owned patents reported that the inventions involved were being used under 50 of the agreements, for a rate of approximately 33 percent. It should be noted, however, that there was no way of measuring the commercial utilization of government-owned inventions by firms which did not request a license from the Government.

When the contractors which held title to patents that were available for licensing are viewed by their percentage of government business, the data show that those firms having 20 percent or more of their business directed toward the Government had a much higher degree of licensing activities measured in the number of licenses entered into and the number of licensees which used the inventions.

C. CASE STUDIES—INVENTIONS OF SOME PUBLIC-ORIENTED AGENCIES

The inventions of Agriculture, Interior and TVA were studied to determine if they achieved a greater degree of commercial utilization because of the public mission and promotional activities of these

[8] These agreements were individually negotiated, as no attempt was made to measure the activity under broad industrial cross license agreements.

agencies. Twenty-five case studies were conducted, involving 47 patents. Five of the patents arose under R&D efforts of TVA, twelve under the sponsorship of Interior, and thirty resulted from Agriculture sponsorship. Twenty-four, or approximately one-half, of the 47 patents were utilized at least to some degree.

Harbridge House concluded that, to the extent that these public-oriented agencies select their research to fulfill public needs, they function like industrial firms searching for new markets or new products—with one essential difference. Since these agencies are not required to earn a profit, they are freer than most industrial organizations to sponsor high risk research with future, rather than imminent, commercial prospects. In addition, these agencies are freer to sponsor research in certain market areas where the makeup of the industry or the market potential does not make it feasible for industry to undertake the research. Several factors were identified as affecting the utilization of the inventions resulting from the research of these agencies, and generally, these factors were closely associated with, and resulted from, the mission concept of the agencies, the type of industries associated with the technology involved, and the state of development of the technology under investigation.

1. Public-orientation of the inventions

Harbridge House reported that the case studies revealed the inventions from these public-service agencies which found commercial utilization achieved broader use in several cases than did the inventions sponsored by the mission-oriented agencies. Among other reasons, this result was achieved because these agencies performed research in areas where there was a demonstrated public need, and a commercial market was available for the inventions when developed. This is in contrast to the findings that the DOD-sponsored inventions, in a great many cases, had no use outside of the government use for which the inventions were intended.

The best examples of the successful and large scale commercial utilization of the results of the inventions from these agencies are the three case studies dealing with TVA inventions relating to the production of improved fertilizers (Cases 15, 16 and 17) [9] and Case 5 relating to inventions of the Department of Agriculture for processing potatoes. into flakes for instant mashed potatoes. In the fertilizef cases, TVA was attempting to increase the productivity of the agricultural community, and in the potato flakes case, the Department or Agriculture was attempting to find additional markets for certain types of low density potatoes. Each of these are classical cases of high market potential, low risk inventions which were fully developed and then promoted by the sponsoring agencies.

On the other hand, a few cases indicated that, even where inventions are oriented toward the needs of particular industries, commercial utilization may not be achieved unless there is a sufficient market, or unless industry is capable or willing to use them. Case 11 is an illustration where the Department of Agriculture attempted to mechanize an industrial process which was normally performed by hand. Primarily due to the fact that this industry was made up of small, family-type businesses, the apparatus developed was found to be too expensive and complex, thereby providing little advantage.

[9] The case numbers refer to the case studies discussed in Part III of Volume IV of the Harbridge House Final Report to the FCST Committee on Government Patent Policy.

2. State of development and promotional activities

Several of the case studies indicated that, despite the commercial orientation of the inventions, additional efforts to fully develop and promote markets for the inventions are often necessary, or at least beneficial, in achieving wide-scale commercial utilization. Harbridge House stated that this additional effort was found to be particularly necessary where the programs of these agencies were directed toward conservative industries, such as the food, textile and fertilizer industries, which perform little research and development on their own. The studies indicated that Agriculture and TVA have become, to a large extent, the research arm of these particular industries.

Once again, the case studies on the three TVA fertilizer inventions (Cases 15, 16 and 17), and Case 5 covering the potato flakes invention of Agriculture, best illustrate the effect that complete development and promotion can have in achieving commercial utilization. In Cases 15 and 16, TVA not only completely developed the processes involved, but constructed pilot plants for demonstrating the commercial feasibility of these processes to industry. Essentially no additional technical development was reported as being necessary, and the potential users only needed to acquire the necessary production facilities. In Case 17, TVA not only constructed a plant to demonstrate the commercial feasibility of the process, but actually sold the resulting product commercially to stimulate market demand. In the potato flakes case, the Department of Agriculture, in addition to developing the inventions, established the commercial potential for the product through consumer studies, where the product was demonstrated and sold in food stores, and advertised through normal commercial channels. Here again, no technical development appeared to be necessary and only a minimum expense in production equipment was required.

In some cases, however, the commercial orientation and potential of the inventions provided sufficient incentives to encourage industry, without exclusive patent rights, to complete the necessary development needed to commercially use inventions not fully developed by the agency. This appeared to be particularly true where the industry toward which the research was directed also had private research programs. Case 1 best illustrates this point, where a company picked up and improved upon a basic process developed by the Department of Agriculture, while depending upon Agriculture to continue to develop new uses for the resulting product.

On the other hand, Cases 4, 7 and 20 illustrate the effect when these agencies do not completely develop inventions to the point of commercial application, and the particular industry involved has little research and development activity of its own. The inventions in Cases 7 and 20 were machines which were developed to the prototype stage, demonstrating their technical feasibility. The agencies did not, however, complete the follow-on development to work out the mechanical problems associated with a commercially usable machine. In both cases, the agencies attempted to interest industry in performing this follow-on work. Although some attempts were made, industry was not willing to finance the development to the point where all of the mechanical problems were eliminated.

Case 4 involved three inventions for reducing food products, and the agency proved the feasibility of the processes in the laboratory. The agency did not, however, develop machinery for performing the processes. Some attempt was made by industry to finance this development work, and the one company which has utilized the invention to some extent has incurred development costs of approximately $300,000. It appears that further development is necessary to commercially perfect these inventions, as the use to date has been small in comparison to what appears to be a quite large potential.

The Department of Interior has encountered a different problem in their saline water conversion program. Under this program, the research involves a technology which has not reached the point of commercial feasibility, and consists of an advanced stage of applied research. Also, this program is in an area where a very large investment is required for additional development, and where there are several parallel technical approaches that are being considered at the same time. Under these circumstances, neither the commercial orientation of the research, the large future commercial potential, nor the promotional activities of the agency appear to be sufficient to achieve commercial utilization at present.

Cases 21 through 24 cover inventions in this area of technology. In Case 22, the technical feasibility of the concept has been proven in pilot plant operations, but a very large amount of risk capital is needed to prove the concept on a commercial scale. And in Cases 23 and 24, industry has obtained exclusive rights to the inventions involved, which still has not produced the needed stimulus to complete the inventions in this high risk area.

3. Patent rights

Exclusive patent rights did not appear to be a major factor in the commercial utilization of most of the public-oriented inventions studied. This was particularly true for inventions which represented high commercial potential and low financial risk as a result of agency promotion and development—again, the TVA fertilizer cases and Agriculture's potato flakes case are examples. In fact, Harbridge House indicated that, in these situations, exclusive rights in one firm might have severely limited the utilization of these inventions.

Again, lack of exclusive rights to the inventions developed under government sponsorship did not hinder commercial utilization in Case 1, mentioned above, as at least one firm continued to develop the Government's basic research at its own expense. In this case, however, exclusive rights did become available to the firm based on its improvements, and as a result, this company is presently the only user of these inventions.

On the other hand, exclusive rights may be useful in achieving a greater degree of commercial utilization than can be obtained through nonexclusive licensing, where the market for the invention is limited. In Case 2, Agriculture did not develop the machine past the prototype stage. Although several firms attempted to further develop the machine, only one firm has had any measure of success. In this particular case, it appears that the market for this machine was quite limited, and intense competition discouraged continuing work on the machine

by some companies.[10] There was also some degree of use of the inventions in Case 4, discussed above, but apparently not as much that would appear to be justified in view of the high anticipated potential for these inventions.

Two of the cases studied are particularly interesting because, although the research was conducted by or through the public-oriented agencies, it was performed at the request of the Department of Defense for the purpose of developing items particularly designed for military uses. Case 6 involves five related patents pertaining to the preparation of material for use in flameproofing fabrics. Although these inventions have been utilized in achieving their particular military purpose, they have not been used commercially to any extent because the process involved is not only complex, but highly dangerous to perform. In Case 18, Interior sought to develop a process for synthetically producing mica. This research was undertaken at the request of DOD because mica was a strategic military item, and most of the natural mica used in the United States had to be imported. After the technical feasibility of this process was proven, Interior was successful in encouraging one firm to assist in the further commercial development of the process through a cooperative research agreement. Thereafter, the cooperating contractor continued the development of the invention with its private funds. This firm reported an investment of over $2 million in private development and has experienced approximately $600,000 in sales annually. The process is not extensively used, primarily due to the competition of the natural mica which is substantially cheaper.

These two cases appear to illustrate the problems encountered in utilizing some DOD sponsored inventions. In Case 6, the process was too complicated and dangerous to stimulate commercial use—factors which did not inhibit their intended military use. Case 18 is an example of an invention which does have commercial application, although it is not sufficiently competitive to stimulate substantial commercial use.

D. CASE STUDIES—PATENT ACTIVITIES OF EDUCATIONAL AND NONPROFIT INSTITUTIONS

In-depth case studies were directed toward investigating the patent activities and promotional efforts of educational and nonprofit institutions. These institutions represented a significant source of inventions within the study sample, accounting for 415 patents developed by 67 institutions. Case studies were conducted on a cross section of 16 institutions, selected to cover a range of factors, including the public and private character of universities, their technical or liberal arts orientation, and their size, geographical location, and amount of government sponsorship of research and development. In addition, patent development firms and nonprofit research organizations were studied, and these included foundations created by industrial associations, single purpose research corporations investigating a specific field of technology, and charitable trusts. The interviews

[10] In such a situation, it could be possible that the market was small and competitive enough as to make it impractical for more than one company to aggressively promote the invention, and perhaps a greater degree of utilization could be obtained with exclusive rights.

were conducted primarily with the individual within the institution in charge of patent policy or patent promotion, and was supplemented by interviews with government contract administrators, administrators of the institutions, and inventors.

1. Characteristics of institution inventions

As a result of these case studies, Harbridge House reported that the inventions arising out of nonprofit institution research have a distinctly different character than those resulting from research by industry, primarily because of the type of research undertaken. In nonprofit research, the end product is often scientific findings as opposed to the usual "hardware" result from industrial research which takes the form of a product or process, at least in the prototype stage. The task of the nonprofit research is generally completed when the institution submits a research report, and not only are funds rarely available to reduce these results to commercial application, the institution normally lacks the motivation and mission to conduct this type of follow-on development. Accordingly, these inventions are frequently at an early stage of development and more often require a larger investment for commercialization.

Another characteristic of nonprofit institution inventions is that they most often stand alone. Their isolation can be a major obstacle to utilization since most inventions are not marketable products in themselves. In contrast, industry is in a position to support an invention with several additional patents and concepts, along with supporting technology and know-how that has been developed through their commercial production and marketing activities.

2. Patenting versus publication

Another major factor which can affect the commercial utilization of these inventions, particularly by the academic institution, is the desire to publish research results as quickly as possible. Invariably, research results are fully disclosed through articles in scientific and technical journals, except where limited by the terms imposed by the sponsor of the grant or contract. Accordingly, patents have traditionally been assigned to a role of relative unimportance, and are often associated with commercial, rather than educational, motives. All but one of the educational institutions interviewed by Harbridge House, stated that publication of research results should not be delayed, even if failure to do so would endanger the patentability of resulting inventions. The desire for publication also has the effect of eliminating any possibility of developing proprietary data or trade secrets often found useful by industry in promoting commercial utilization.

3. Promotional activities

As the nonprofit institutions do not make or sell products or processes embodying their inventions, they must depend upon licensing of these inventions in order to achieve utilization. Harbridge House found that these institutions have evolved a variety of licensing techniques and used them in varying degrees to transfer the results of their research to the marketplace. Some colleges and universities have their own licensing programs under which special administrative units are responsible for obtaining sponsors to further develop and

market inventions. Other educational institutions administer their patent programs through independent, but affiliated, foundations, and in these instances, inventions are assigned to the foundation by either the institution or by the inventor directly. And finally, a large percentage of academic institutions utilize patent development firms to administer their patent programs.

The case studies indicated that, except for a few universities, there has been little activity within academic institutions toward active promotion of inventions. However, Harbridge House reported that the concern for patents and the resulting patent activity in these institutions is beginning to increase as these institutions search for additional sources of income.

There is a substantial variation in the concern for and activities regarding patents among the institutions, and this is best illustrated by the two institutions described in Cases 1 and 8.[11] The university described in Case 1 is highly patent conscious, requiring mandatory assignment of all inventions to the university and providing for a liberal division of royalties with the inventor. Under a policy change in 1963, this university permitted the inventor to receive 50 percent of the net royalities resulting from the licensing of a patent, and since the adoption of this policy, disclosures reported to the university have increased by 600 percent.

As a matter of policy, this university will file patent applications only if there is a reasonably foreseeable market, and it appears likely that the resulting costs can be recovered through licensing of the invention. The university will seldom undertake promotion of an invention without exclusive patent rights because of the inability to offer any particular incentives to firms seeking to develop the invention. The institution had the most active utilization program in the study and used a variety of promotional activities. This particular university was the only one identified in the study which would consider delaying the publication of its research findings in order to insure patent protection.

In contrast is the university described in Case 8, which has no interest in patents at all. Except for the area of public health, where the university requires the dedication of inventions to the public, the university does not require the assignment of inventions, and it requires the sponsor of grants and contracts to negotiate patent agreements directly with the principal investigator involved. The university not only refrains from filing patent applications and promoting inventions, but also provides legal advice to staff members who wish to prevent the patenting of their discoveries by others. This policy is so much a part of the philosophy of this university that, in the past, it has even declined to accept patents as a gift.

The other educational institutions interviewed fall somewhere between these two extremes, with varying amounts of activity in identifying, patenting, and promoting inventions, and provide varying amounts of incentives to inventors. Most of these institutions make use of the patent development firms for patenting and promoting inventions which they own.

Several of the case studies appear to be of special interest. For example, the research institute covered in Case 13 indicated that

[11] The case numbers refer to the case studies discussed in Part IV of Volume IV of the Harbridge House Final Report to the FCST Committee on Government Patent Policy.

ordinarily the institute's policies provide for allowing patent rights to pass on to the sponsor of the research. There was one striking exception to this policy, however, and that was in a field in which the institute has maintained a dominant and proprietary position for several years. In this one area, the institute will insist upon retaining exclusive rights to resulting inventions regardless of whether the research is sponsored by the Government or an industrial customer. This case illustrates once again that firms, both profit and nonprofit, become highly patent sensitive in areas where they have prior investment and a commercial position.

This shift in sensitivity to patents is also illustrated in Case 16. The patent development firm interviewed in this case was one of three affiliated corporations, the other two being a nonprofit research institute and a manufacturing subsidiary which engages in prototype development and promotion of promising inventions for which the patent development firm cannot find industrial licensees. The research affiliate expressed relative disinterest in patents, considering them a subsidiary result of the main mission of solving scientific problems of their research sponsor. The feeling was also expressed that, due to the more basic type of inventions resulting from their research, there is less need for patent protection. On the other hand, the attitude of the manufacturing and development affiliate was quite the opposite, and this firm stated that they would not even consider working with an invention where the Government had retained title.

E. CASE STUDIES—HIGH AND LOW UTILIZING CONTRACTORS

The industrial contractors identified as having the highest and lowest rates of commercial utilization of the inventions in the two year sample were interviewed to identify the factors which affected the utilization of patents by these firms. In addition, the interviews were intended to gather more general information on the firms' attitudes toward patents, the scope of the firms' privately sponsored research, and the relationship of the firms' government sponsored and privately sponsored research. Whenever possible, interviews were conducted with managers of various functions in each company to obtain a balanced view of the role of government patents and government patent policy in the business affairs of these organizations.

Twenty-one industrial contractors were interviewed in all, ten of which were classified as high utilizing firms (having a utilization rate of 12 percent or higher) and eleven firms were classified as low utilizers (having a utilization rate of 7 percent or lower). Because the number of patents held and commercially utilized by responding firms in the two year sample were concentrated, the twenty-one firms interviewed accounted for 53 percent of the inventions and 130 of the 200 inventions used by industrial contractors.

The case studies showed that industrial organizations focus their attention on marketable products, and not on the exploitation of inventions per se. For this reason, evaluation of an invention's market potential, applicability to commercial uses, and expense of development generally take precedence over those factors directly relating to the patentability of the invention or to the rights that a firm may have to it. It was found that some types of firms, for example those

that develop large systems, rely on broad management and engineering skills rather than patent protection to maintain their market positions. In other situations, where the invention is directed to markets that change rapidly, current technology is quickly bypassed and the value of a patent may be short lived at best. In these types of situations, therefore, the availability of patent rights may make very little contribution to the decision to utilize inventions.

Thus, the development risk in commercializing an invention in relation to its expected commercial potential influences a company's concern for patent rights. In a high-risk, low-potential situation, lack of exclusive rights often is a factor retarding commercial development. On the other hand, in a low-risk, high-potential situation, a company may utilize inventions in their commercial products without regard to patent rights. Harbridge House generally noted, however, that the greater the company's investment in research and development of new commercial products, the greater was its sensitivity to patent protection.

1. Barriers to Utilization

The interviews of the twenty-one high and low utilizing firms indicated that the most fundamental factor affecting the commercial utilization of the great majority of the sample inventions was low commercial potential. Harbridge House concluded that many of these inventions, derived mainly from defense programs, are too far from consumer needs to be very useful. Developed under hardware programs in many instances, these inventions represent applied engineering to meet a specific military requirement which tends to limit their applicability to commercial products.

Several examples are found in the descriptions of the high and low utilizing companies of the difficulties involved, or the development costs incurred, in attempting to achieve "spin-off" uses for these military oriented inventions. In the description of Company A,[12] two examples are given of unsuccessful attempts to commercially produce and market products based on such inventions, both of which were subsequently abandoned. One of the attempts is particularly in point, as the company reported that the competition in the commercial market was significantly different from the similar military market. The military market was based on tight government specifications with heavy emphasis on reliability, as opposed to the more cost conscious commercial operation. As a result of these experiences, this company has generally abandoned its efforts to develop commercial "spin-off" from government sponsored inventions.

The companies interviewed indicated that their market orientation had a major effect on utilization. It was found that firms that were almost totally oriented toward government work and which have little or no interest in commercial business showed little interest in utilizing inventions. In a similar manner, firms that were almost totally oriented in commercial markets, to such an extent that they separated their government and commercial work in order to eliminate any question of the rights, also showed little interest in attempting to utilize government sponsored inventions. However, with this

[12] The companies mentioned in this section are described in Part II of Volume IV of the Harbridge House Final Report to the FCST Committee on Government Patent Policy.

latter type of firm, the opposite position was held in regard to inventions resulting from their privately sponsored research.

2. Dominant industrial attitudes toward Government patent policy

As a result of the interviews of the twenty-one industrial firms included in this portion of the study, Harbridge House identified six basic attitudes reported by these firms on the importance of inventions derived from government research and development and on the importance of government patent policies. It might be noted that the attitudes of these firms depend in a large measure on the commercial orientation of the firm. Similarly, the attitude of a division of a large multi-division corporation depended in large measure on this same factor.

Attitude No. 1—Patents Have no Importance to the Firm's Commercial Activities.—Firms displaying this attitude were characterized as doing a preponderance of their business with the Government in aerospace and defense markets. These firms, being government oriented, had no desire to expand into commercial markets and had no mechanism for using the inventions commercially. Harbridge House speculated that variations in government patent policy with respect to the ownership of patents would have little effect on either the participation of these firms in government contracts, or in the utilization of inventions resulting from such contracts.

Attitude No. 2—Patents Have Little Value to Commercial Activities.—Firms expressing this attitude indicated that patents have little value to their business activities in comparison with technical and management competence, production capability, and corporate reputation. These firms were generally manufacturers of complex systems and technical products, such as aircraft, jet engines, computers, or communications equipment. Although these firms are generally heavily oriented toward government sales, they frequently sell similar products in commercial markets. The inventions developed by these firms in the course of government R&D activities tend to be auxiliary components, subsystems, or incremental improvements of their products. As viewed by these firms, this type of invention is not as important in sustaining sales of commercial products as the basic engineering, management, and production capability of the firms, and these component-type inventions are incorporated into product modifications with little consideration being given to patent rights.

Although the firms with this attitude considered patent rights as being valuable (primarily for defensive purposes, flexibility of design, providing rewards to inventors, and as possible royalty income producing property), they still considered technical know-how in the management of large system projects as being substantially more important. These firms generally depend upon government contracts for most of their business, and will give higher priority to full participation in government programs even where their commercial and government work overlap. Accordingly, Harbridge House indicates that a variation in patent policy would probably have little effect on the utilization of government sponsored inventions or in participation in government R&D programs.

Attitude No. 3—Patents are Valuable for Defensive Purposes.—The importance of patents becomes stronger with firms having this

attitude, as they consider them important in assuring flexibility in design, for cross licensing purposes, and for protecting their commercial markets. Ownership of patents, however, is not a prerequisite for new product development and is a relatively minor factor compared with market considerations and investment requirements associated with commercializing an invention. Frequently, these firms, although desiring as much patent coverage as possible, are in commercial markets that require early entry of new products, with or without patent coverage. Harbridge House indicates that these firms will choose more carefully the areas in which they will undertake government contracts if they are not permitted to obtain exclusive rights to patents, and may refuse to contract in certain areas.

Attitude No. 4—Patents are Important in Establishing Proprietary Market Positions.—The firms expressing this attitude actively seek ownership of patents to establish and maintain proprietary positions in commercial markets, and the makeup of their patent portfolio may indicate the direction of product development in order to strengthen their proprietary position. Predominant among the firms with this attitude is a relatively low percentage of government business, and an interest in accepting government contracts directly related to their commercial markets where the results would have a greater possibility of being commercially useful. Harbridge House speculated that a patent policy which denied exclusive patent rights to these firms would limit their participation in government R&D work because of the possible conflict with privately financed activities, and accordingly, these firms would refuse to compete for government contracts in many cases.

Attitude No. 5—Ownership of Patent Rights is Fundamental to Business Operations.—Firms in this category express the strongest concern over government patent policy, regard patent rights as essential to their business activities, and carefully avoid government claims or conflicts over ownership of inventions. Even though the firms with this attitude share the same concern for patent rights, their policies direct them into one of two business patterns.

Firms adopting the first pattern operate much like the firms with Attitude #4 as they deliberately select areas of government research that overlap with their own commercial interests. However, these firms stated that they will normally first assure corporate ownership of patents before contracting with the Government, either by negotiating contracts which permit them to retain title to resulting inventions, or by developing and reducing to practice inventions that have been conceived prior to contracting with the Government. Accordingly, Harbridge House concluded that policies which would prevent these firms from retaining exclusive rights to inventions would limit their participation in government contract work.

The firms adopting the second pattern of operation took the opposite approach of the firms with the first pattern, as they deliberately isolated government work from their commercial operations. The two companies identified with the second pattern were both large companies having over $1 billion in annual sales, and both had very small percentages of their business directed toward government activities, 2% for one company and 10% for the other. As these companies felt very strongly about retaining rights to inventions, were highly oriented

to the public markets, and deliberately isolates their government work, they may generally be considered as viewing their government work as mainly a public service. Accordingly, insofar as their government business is concerned. Harbridge House believes that a policy which acquires title to inventions would have little effect on their participation with the Government, and little effect on the utilization of resulting inventions. However, insofar as accepting contracts under a title policy in the commercial side of their business, they would probably act in accordance with the firms using the first pattern, if they would accept such contracts at all.

Attitude No. 6.—Patent Rights in Commerical and Government Activities are Judged by Different Standards.—Large diversified firms were reported to have different attitudes toward patent policies in their commercial and government markets, placing strong emphasis on acquiring proprietary rights in their commercial markets, and expressing a relative lack of interest for patents arising from their government work. The divisions of these corporations, therefore, express the same general types of attitudes as were described for companies in Attitudes #1 through #5, depending upon the profile of the division concerned. The primary distinction between the second pattern under Attitude #5 and this attitude is that these firms do not necessarily have very low percentages of government business and do not separate their government and privately sponsored work for the express purpose of isolating the two. This separation, when it occurs, is more the natural result of the technology involved or the type of work undertaken by the particular division.

In summary, Harbridge House reported that the results of the study of the high and low utilizing industrial firms indicate that the greater a company's commercial interests and investment in commercial research and development becomes, the greater becomes the firm's sensitivity to patent protection, and in turn, its concern with government patent policy. This finding is supported by the case studies of the inventions from the public-oriented agencies, and by the in-depth studies on the participation of contractors in government R&D programs.

F. CASE STUDIES—INDUSTRIAL PARTICIPATION IN GOVERNMENT R&D

The Committee realized that possibly the greatest effect patent policy could have on participation is the refusal of potential contractors to bid on government work or to refuse to submit proposals. Such an effect is not susceptible to quantitative measurement, as there is little documentation available, at least within government files. Nevertheless, the Committee believed it important to obtain as much relevant information as possible on this particular issue.

Accordingly, Harbridge House was asked to investigate several cases of refusals to contract, or problems encountered in the contracting process, created by patent policy questions which were known and documented in the files of two agencies represented on the Committee (HEW and Interior). Although the study of a few cases would not provide a measurement of the frequency of such occurrences, or measure their impact on government programs, the Committee believed it would provide some understanding of the types of situations that

arise and of the concerns regarding patent policy held by government contractors.

1. Studies of the NIH university grant program

a. Background

Twenty-one NIH cases were studied by Harbridge House, nineteen of which deal with the refusal of pharmaceutical firms to collaborate with university investigators in the biological testing of compounds developed under NIH medicinal chemistry grants. The remaining two cases deal with refusal to contract with NIH. Harbridge House conducted an investigation of the interrelationship between NIH, the university community, and the pharmaceutical industry in performing work under, and in developing the results of, NIH's medicinal chemistry program. In conducting this phase of the study, Harbridge House interviewed various technical and management personnel in five drug firms, faculty members and administrators of seven universities, management and research personnel of a commercial testing laboratory, and patent, management and technical personnel within HEW, PHS and NIH. [13]

Drug research is an important aspect of the Government's health program, and maximum utilization of research results for the benefit of the general public is a basic objective. The drug industry forms a vital link in this utilization process and is highly patent sensitive because of its large expenditures for research and development which has a relatively low yield of new products. Patent rights, therefore, are viewed as a necessary protection to insure amortization of investment and adequate return for research expenses.

Under NIH's medicinal chemistry grant program, which may involve 500 to 800 grants each year and an annual appropriation of approximately $8 million, new compounds believed to have medical value are developed, chemical synthesis techniques are studied, the relationship of chemical structure to biological activity is investigated, and research opportunities to promote professional development of medicinal chemists are provided. The results of these grants take the form of a number of synthesized compounds, and at this point NIH support normally stops, depending upon the publication or other dissemination of the results of this basic type research to stimulate further development efforts within the private sector.

Prior to 1962, drug firms screened these compounds for the university investigator free of charge, under what was normally an informal verbal agreement which provided that the drug firm would test the compounds and report the results back to the investigator, in return for some form of exclusive rights whenever the compound appeared to have utility. It should be emphasized that this relationship is not the usual Government-contractor relationship described throughout most of this study, but one where the results of the Government's basic research is picked up, investigated and developed by industry at its own expense.

Although NIH, under HEW regulations, has a general policy of acquiring title to the results of their research programs, there was

[13] The Comptroller General of the United States issued a report "Problem Areas Affecting Usefulness of Results of Government Sponsored Research in Medicinal Chemistry," dated Aug. 12, 1968, B–164031(2), which generally confirms the Harbridge House findings.

never any requirement for a formal agreement prior to 1962 between the university investigator supported by NIH and the screening organization concerning the use and rights to compounds synthesized by the investigator. In 1962, however, NIH began requiring the university investigator to obtain a patent agreement signed by the screening organization before they would be permitted to screen compounds synthesized with NIH funds. This agreement provided that the ownership of any inventions attributable to the investigator was subject to disposition by the Government.

The drug firms almost unanimously refused to sign the patent agreement required by NIH and, as a result, no longer participated in the screening of NIH sponsored compounds. This action was based on several reasons. Not only did the drug firms fear the loss of some measure of exclusive rights to the specific compounds that they were testing, but they also feared that the Government could assert rights to any privately developed research related to these inventions.[14]

b. Costs and Benefits of Screening to the Drug Firms

For the drug firms, the cost of initial screening of the academic compounds is relatively low, being a marginal cost in most instances because these compounds are merely added to the in-house compounds going through the screening process. Before their withdrawal in 1962 from screening of these compounds, the drug firms received several benefits for these services. First, they acquired some measure of exclusive rights to the development and marketing of those compounds which appeared to have market potential. Second, the screening of these compounds gave the firms wider accessibility to both compounds and new ideas in medicinal chemistry, thereby increasing the chance of developing marketable products, This increase was slight, however, as the chances of discovering a compound having a market potential has been estimated at approximately 4,000 to 6,000 to 1.

A third benefit of this screening to the drug firms was the savings of the costs for synthesizing the compounds, which are estimated at approximately $3,000 per compound. However, the drug firms still had to support the costs required to develop the compound to a point where sufficient data were available to properly support a new Drug Application, which may cost from $200,000 to $500,000. And finally, the screening of these compounds provided a fruitful relationship between the drug firm and the university which often identified graduate students for recruitment purposes, and investigators that could be used as consultants.

c. Effect of the Withdrawal of Screening Services on the University

The withdrawal of the drug industry from providing large-scale testing and screening services to the university investigator produced many detrimental effects. Among them is the fact that, in many instances, compounds synthesized by the investigator simply accumulate and remain untested with no insight to their biological activity. One detrimental effect is that the lack of test data often prevents the

[14] It should be noted, however, that a revised version of this patent agreement adopted in December 1966 has met with some limited success in clarifying the rights of this type of research, but to date, this change has not been successful in achieving an overall solution to this problem.

publication of the results of the research, which is one of the primary objectives of the medicinal chemistry grant program. This is the result of a standard requirement of most medical journals that papers submitted for publication contain the results of some pharmacological or biological testing. This situation is relieved somewhat through the use of alternative screening facilities or the obtaining of test results from the Government's screening programs for cancer and malaria research. When compounds are tested through the Government's screening programs, however, the screening is limited and they often do not receive the type of screening most appropriate to their nature and potential usefulness, although it may assist in publishing the results of the investigator's research.

Another significant effect appears to be the complete disruption of the interplay between the academic research community and the drug industry. There has been a serious weakening of the communications links vital for the productive interchange of research ideas. Drug firms reported a fear of "contamination" of their privately financed research by any involvement with academic investigators supported by NIH to perform research in similar areas. Practically every scientist interviewed by Harbridge House evidenced concern over the comparative isolation of academic investigators and their counterparts in the drug industry.

d. Alternative Screening Sources

There are generally three alternative screening sources available to the principal investigator that can be used as a substitute for the screening services that, prior to 1962, had been provided by the drug industry. One of these alternatives is either of two government laboratories, the Cancer Chemotherapy National Service Center (CCNSC) and the Walter Reed Army Institute of Research (WRAIR). These two government laboratories provide specific screening of compounds through contracts with industrial organizations to identify compounds which show some activity in connection with either cancer or malaria. The effect of the withdrawal of the screening services of the pharmaceutical industry does not materially affect the screening of compounds in either of these areas.

Another alternative is the commercial and nonprofit testing laboratories which will provide a full range of testing for any compound. While the in-house skills of some of these testing organizations would appear to be sufficiently varied to allow them to develop the compounds to the point of utilization, their experience is not as extensive as that of the drug firms. Also, these organizations are not a suitable alternative because they operate on a contract basis, and their costs tend to be too high for use by the university investigator, as NIH normally is not willing to supply funds for this purpose under the grant program.

The third alternative for screening is in the university's own facilities. Several universities reported that they have set up screens to obtain rough qualitative data on compounds of interest to their professional staffs. Such facilities are not available at most universities and when they are, they provide only limited services. They do not appear to offer screening services as effective as those available in the drug industry and have little interest in active compounds beyond finding out why they are active.

2. Studies of Interior cases

Prior to 1960, Interior developed its own patent policy under which it generally acquired title. However, where this would be inequitable, title was left in the contractor, with the Government retaining a royalty-free license and the contractor agreeing to license the public on a reasonable royalty basis. After the enactment of the Saline Water Conversion Act and other legislation pertaining to Interior's programs, the Department altered its patent policy to conform with these acts which require that the government take title to inventions developed under contracts. In addition, Interior normally attempted to obtain a royalty-free government license to the contractor's background patents, and required the contractor to license such background patents to others at reasonable royalties.

Twenty-four cases were studied involving patent problems which arose during negotiations of contracts or grants in the Department of Interior. In eight of these cases, the contractor accepted Interior's patent provisions, six cases resulted in contracts only after some modification was made in the patent clause which did not affect rights to inventions made under the contract, and ten cases resulted in refusal to contract. Of these ten cases, two involved research falling under the Saline Water Act which requires free availability to the public of resulting inventions, and three involved research falling under Section 1(a) of the Presidential Policy which requires that the Government normally acquire title to resulting inventions. In addition, three of the ten cases involved problems of background patent rights, and in the remaining two cases, the contracts were apparently rejected before an attempt was made to resolve the problems involved.

Twenty-three of the twenty-four case studies are summarized in the Harbridge House Final Report, and it is surprising to note that ten universities and one "institute" were involved. The problems in these eleven cases varied considerably, as did the ultimate result, but all involved patent clauses that would acquire title to inventions by the Government to foreground inventions and/or certain rights to background inventions. In two of the cases the contracts were refused because the acceptance of a title clause would conflict with arrangements for the allocation of patent rights made with other cosponsors of the research (Cases 1 and 19).[15] In three other cases, the universities were concerned that the patent clauses could be interpreted broadly enough to cover other research work being conducted by the university: in one case, the clause was eventually accepted (Case 3); in another, the contract was refused (Case 17); and in the third case, the clause was deleted because the work would be covered by regulations applicable to government employees (Case 18).

In two other cases where universities refused to contract with a title clause, one university refused to contract because of the strong personal feeling of the principal investigator (Case 11), and the other accepted the contract after the clause was modified to eliminate a royalty-free government license to background inventions and to exclude two prior exclusively licensed inventions from the patent clause altogether as being outside the university's control (Case 13).

[15] The case numbers refer to the case studies discussed in Part IV of Volume II of the Harbridge House Final Report to the FCST Committee on Government Patent Policy.

One case was considered as a refusal to contract, although no formal contract was made with the university because of prior knowledge that a title clause would not be accepted because of an established background position (Case 9). The final case concerned the university's inability to guarantee compliance with the patent clause, and the contract was executed after the clause was appropriately modified.

Of the twelve remaining cases dealing with private firms, the reasons for the problems were much more concentrated and primarily involved the firm's desire to protect its own private development efforts in the area of the research. Seven of the twelve cases fell in this area, with four of the firms refusing to contract (Cases 10, 16, 20 and 23), although negotiations were still continuing in one case at the time of the study. Two of the other firms eventually accepted the contracts after the clause concerning background patents was modified (Cases 12 and 15), and one firm accepted the contract without modification to the clauses for the stated reason that the research was not expected to be productive of inventions (Case 5).

In the other five cases involving private firms, the objection to the patent clauses were general and not specifically connected with prior privately financed developments. In two cases, the clauses were accepted, again for the stated reason that the research was not expected to be productive of inventions (Cases 6 and 7). In the other three, one firm refused to contract (Case 21), one accepted the contract after modification of the background patent provisions (Case 14) and one accepted the background provisions after they were further interpreted by the Department of Interior (Case 22).

Two of the Interior cases are particularly interesting, one because of the stated position of a small business firm, and the other because of the differing response of a firm to changing requirements of the patent provisions. Case 10 involves an attempt to contract with a small business firm which apparently had a substantial amount of private investment and a background patent position in the area of the research work. The firm ultimately refused to contract because of its belief that, without exclusive patent rights, it would not be able to compete with the large corporations working in the same area.

The firm in Case 20 originally contracted with Interior in 1960 under a joint sponsorship arrangement where the firm financed one-half of the research effort. This contract apparently permitted the firm to retain title to resulting inventions. In negotiating a follow-on contract, Interior was required to modify the patent clause to conform with the patent provisions of the Saline Water Conversion Act, calling for government ownership of title to foreground inventions. The firm accepted this patent provision, but the contract was changed from a joint-sponsor program to one fully paid for by the Government. When Interior requested a royalty-free government license to the firm's background patents during negotiations for additional follow-on work, the firm refused to continue because of its inability to recoup its private investment in the research.

G. CASE STUDIES—EFFECTS ON COMPETITION

In evaluating the impact of patent policy on competition, it is important to distinguish the effects that such a policy might have

from the general effects which may result from industrial participation in government R&D programs. Competitive advantages in commercial markets may well accrue to contractors through government funding of R&D work, especially when the work parallels commercial areas of interest. Advantages may also be obtained as a result of this work through knowledge gained in new technologies and through the sharpening of technical skills of the contractor's scientific personnel. However, these advantages are quite separate from the advantages which may result through the ownership of patents to specific inventions. This study attempted to measure only the effects of the patents per se.

Measuring the impact of government-sponsored patents on competition is extremely difficult, and not unlike previous attempts that have been made to measure the impact of the patent system in general, An exhaustive analysis of this impact would, of necessity, include the study of several types of markets and technology, and attempt to measure the cumulative effect that government patents have had over an extended period of time. This type of detailed study was beyond the resources and scope of the study sponsored by the Committee.

Under this study, an attempt was made to measure the effect on competition of the sample inventions considered in this study, primarily through the data accumulated by the questionnaires, and through the indepth studies directed toward refusals of contractors to license government-sponsored inventions and attempts to enforce patents.

The questionnaire data provided a considerable amount of general, or background, type of information which would allow for some assessment of the competitive impact of the patents. For example, the questionnaire data indicated that about 95 percent of the patents resulted from the research of mission-oriented agencies, which Harbridge House found to have very small applicability to commercial markets. Fifty-five of the 210 inventions utilized commercially by government contractors were reported to be critical to the end product or process in which they were used. All of these utilized inventions accounted for a reported $406 million in accumulated sales over several years and the sales of the items involving critical inventions was reported as $241 million—a relatively small figure when compared to the total sales of these firms over the same number of years and to the industries in which they participated.

1. Licensing of inventions

The industrial contractors responding to the questionnaire held exclusive rights to 1,618 patents in the response, and 1,539 or 95 percent, were reported by these firms as being available for licensing. Each firm which reported a refusal to license was interviewed, and as a result, Harbridge House concluded that there was actually only fifteen patents that were unavailable for licensing. Of the patents reported as available for licensing, 175 requests were made for licenses, and 138 resulted in license agreements. Use was reported under 77 of the license agreements.

The data also indicated that, in general, industrial contractors licensed their inventions fairly rapidly, as 58 percent of those inventions which were licensed, were licensed within three years of the date on

which an application for patent was filed. In addition, a check was made of the twenty-six inventions used by the contractors and licensed to others to determine if there was any delay experienced in licensing inventions when the contractor himself was using it. For these twenty-six patents, only eleven cases were found where the license agreement was entered into more than one year after the first commercial use by the contractor. Investigation of these cases indicated that, in every instance, a license was granted within a year of the first serious request for a license.

The fifteen patents that Harbridge House identified as being unavailable for licensing involved only five companies. One of the five companies, holding eight of the fifteen patents, categorically refused to license competitors when patents were associated with his commercial market. This company was using three of the eight patents which it held. The remaining four companies selectively refused to license patents which they were using, depending upon their evaluation of the patent and the specific market condition.

Summarizing the results of the identified refusals, it was found that only three of the patents involved inventions which had a critical role in the products sold, and only one of the critical role patents had substantial sales. This patent was owned by a large contractor and was critical to the scroll structure of a gas turbine motor which had enjoyed sales of $60 million. The study indicated that the patentee had several active competitors in this field which used alternative technology, although the study provided no information on the relative market positions of the competitors or on the relative economics of the technologies used. The second critical invention was owned by a small firm (under $5 million in annual sales) and accounted for $66,000 in sales, with a development cost of $2,000. The third critical invention had realized sales of only $11,000 in both commercial and government markets.

Of the supporting role inventions, three involved features for a jet fuel flowmeter, representing improvement in a basic patent already owned by the company. The company had invested $1.45 million to commercialize the product and had accumulated sales amounting to $1.8 million. A fourth supporting role invention owned by the same company had been developed at a reported cost of $300,000 and had produced sales of only $13,000. Because of this, the company indicated that this invention is now available for licensing.

When the overall questionnaire response was considered, Harbridge House found that only 1 percent of the patents owned by the large contractors (over $50 million in sales) were reported as unavailable for licensing, whereas smaller firms (under $50 million in sales) indicated that 7.6 percent of their inventions were unavailable for licensing. When the patents were in use by the contractor, the tendency to refuse to license others increased—larger firms refusing to license 3.8 percent of the inventions they themselves were using, and the smaller firms refusing to license 13 percent. In summary, Harbridge House concluded that the effects of the refusal to license was negligible. In the one case where the patent appeared to have an appreciable commercial market, there were competing alternative methods for performing the same function.

2. Litigated patents

All of the patents in the sample were checked to identify any attempts to enforce them through litigation. Sixteen suits involving eleven patent owners were found, but further study indicated that only ten of the suits involved patent infringement—the others involving primarily claims for misappropriation of trade secrets. These ten suits were covered in eight case studies conducted by Harbridge House.

Except for one case, Harbridge House concluded that there were no adverse competitive effects resulting from these cases. All of the cases which had been terminated were settled out of court, with no injunctive relief being requested or granted. Also, it was found that, in general, the patent owners were willing to license the inventions, and that the biggest problem was their attempt to identify possible infringers.

One case, involving a synthetic process for producing an important mineral, was identified as having an adverse effect on competition. This process was instrumental in creating a small, but growing industry. The exclusive licensee is willing to license those in the industry which are presently using the invention, but at a royalty rate which will apparently make their operations unprofitable. Harbridge House concluded, as a result of the study of this case, that it is untypical of government inventions in general.

Part III—Application of the Study Results to the Presidential Policy

A. GENERAL CONCLUSIONS

The Presidential Memorandum and Statement on Government Patent Policy was developed over an eighteen-month period by the Office of Science and Technology in consultation with representatives of twenty federal agencies. The policy was based on more than twenty years operating experience of the agencies with the policy issue, and in light of the information and facts gathered through numerous Congressional hearings and studies. In the last three annual reports on government patent policy issued by the Federal Council for Science and Technology, it was found that the Presidential Policy had been effective in several respects, particularly in bringing the patent policies and practices of the federal agencies into greater consistency and in obtaining a greater degree of protection of the public interest.

Because of this extensive background on which the Presidential Policy is based, it was not anticipated that the results of this single study effort would be decisive in indicating the need for a major policy change. Rather, the study was intended to gather facts and information which would assist in reaffirming or suggesting modifications to the basic criteria underlying the policy. In the June 1966 Annual Report on Government Patent Policy, the Federal Council, after stating that the policy had been effective in several respects, indicated the need for more information as follows:

> There are, however, three key areas where few facts have been accumulated and in which there is need for considerably more information. These areas pertain

to the effects government patent policy has on (a) contractor cooperation and contract performance, (b) the utilization of government-financed inventions in the civilian economy, and (c) competition in commercial markets.

It is precisely in these three areas that the efforts and findings of the Harbridge House study were directed. Accordingly, the following sections of this Part correlate the results of this study effort with the provisions of the Presidential Policy, and provides the Committee's opinion on whether the data collected either supports the provision, or indicates the need for possible modification.

In general, the Committee finds that the study results provide no basis for changing the basic principles of the Presidential Policy, although they do indicate a few areas where modification in the criteria would be appropriate. In particular the study confirms the statement in the Presidential Policy that: ". . . a single presumption of ownership does not provide a satisfactory basis for government-wide policy on the allocation of rights to inventions."

Throughout the study effort, the identification of factors that might be found surrounding an invention or a contracting situation which affect the utilization, participation, and competition issues, demonstrated that a single "title" of "license" policy would not be in the public interest, whether applied to a government-wide policy or to the policy of any particular agency. The study results indicated that to increase participation and utilization, government patent policy must accommodate itself to factors other than patent rights that have a great influence on these goals—for example, the market potential of an invention, the organizational and commercial structure of government contractors, the development and promotional activities of the government agencies, and the state of development of the invention. By taking these factors into consideration, the data suggests that the allocation of patent rights can have an influence on the three policy objectives.

B. SECTION 1 (a)—GOVERNMENT ACQUISITION OF TITLE

Section 1(a) of the Presidential Policy Statement sets forth four areas where the Government should normally acquire title to inventions at the time of contracting, and also defines the exceptions that can be made to this policy. Briefly stated, this section states that title should normally be acquired by the Government where (1) a principal purpose of the contract is to develop or improve products or processes intended for use by the general public, or where public use will be required by governmental regulation; (2) a principal purpose of the contract is for research directly concerned with the public health or welfare; (3) the contract is in a field of science and technology primarily funded by the Government; and (4) the services of the contractor are for operating a government-owned facility or for coordinating the work of others. The research contract developed information and data on the first two title taking categories, but little or no data regarding the second two.

The Committee finds that the data developed under the Harbridge House contract generally supports the normal acquisition of title by

the Government whenever the purposes of the contract are public-oriented (Section 1(a)(1)). The Harbridge House study indicated that exclusive rights were often not necessary in order to achieve commercial utilization in this area for the following reason:

(1) The inventions derived from this type of research were normally directed towards areas where there is a waiting commercial market or a present public need for the results of the research;

(2) Often the research results from this type of public-oriented contract are developed to the point where the technical and commercial feasibility of the results has been demonstrated, and little additional private investment is required in order to market these inventions; and

(3) When agencies support this type of research, they sometimes follow up the research with promotional and marketing activities directed towards the industries most concerned.

In addition, Harbridge House concluded that when these three factors were present and where further development costs were minimal and the commercial potential of the research results was high, exclusive rights in one organization may inhibit widespread use.

However, as indicated throughout the study, an inflexible presumption of ownership of patent rights is not in the public interest, even where the above circumstances exist, as several examples were identified where exclusive patent rights may be necessary or helpful in obtaining widespread utilization in the public interest. The Committee believes that these situations can be adequately handled in the exceptional circumstances and the greater rights provisions of Section 1(a) which will be discussed in Section C of this Part.

Less data were accumulated under the contract on Section 1(a)(2) of the Presidential Policy concerning the health and welfare areas, except as this subsection overlaps with Section 1(a)(1). For example, few inventions from HEW were found in the two-year sample. However, the survey of the interrelationship between NIH, the university community and the pharmaceutical industry in the NIH medicinal chemistry grant program demonstrated the participation problems that can arise from a government patent policy that takes title when the Government's support does not progress beyond the more basic research levels, and when the industry involved is patent sensitive because of its own related R&D investments in furtherance of its commercial position. Studies of other agencies and the in-depth studies indicate that if these factors are present, there may be a participation problem regardless of whether the research is directed towards the health-welfare field or any other field. Again, the Committee believes that the proper application of the exceptional circumstances and greater rights provisions of this section would appear to be sufficient to resolve the patent problems in this health-welfare area, even though they may occur more frequently than under subsection 1(a)(1).

No data was collected which directly concerned paragraphs (3) and (4) of Section 1(a). Therefore, the Committee has no basis to recommend changes in these provisions which are founded on what appears to be sound principles.

C. SECTION 1(a)—EXCEPTIONAL CIRCUMSTANCES AND GREATER RIGHTS

The latter part of Section 1(a) states that, in exceptional circumstances, the contractor may acquire rights greater than a nonexclusive license at the time of contracting when the agency head certifies that such action will best serve the public interest. The Patent Advisory Panel has interpreted this provision to be applicable to either all inventions developed under the contract, or to particular inventions identified prior to contracting. Section 1(a) also provides for granting greater rights after contracting to the contractor to identified inventions where such rights are a necessary incentive to the utilization of the invention, and where such action is consistent with the overall intent of Section 1(a).

The Committee believes that the Harbridge House study indicated the necessity for providing exceptions to the government title taking provisions of Section 1(a). The necessity or usefulness of exclusive rights in attracting contractors or in obtaining utilization of these inventions was found to vary considerably, depending upon such factors as the amount of privately financed R&D undertaken by the contractor in areas related to the research, the state of development to which the government agency carries the invention, the research orientation of the industry that must use the invention, and the commercial orientation or promotional abilities of a contractor.

For example, the in-depth studies demonstrated that a few contractors would not undertake government contract work in limited areas, or would not further develop the results of such work when exclusive rights to the inventions were not available because of possible conflict with company-sponsored research activities in their commercial fields. The effect of such a refusal by any particular contractor on an agency's program would depend on that agency's ultimate research mission and goals, and the particular agency program involved. Accordingly, the Committee believes it important for each agency to have the authority to make exceptions to the presumption of government ownership whenever such action would materially assist the agency's research programs and further the public interest.

Similar discretion is needed by the agencies in obtaining utilization of resulting inventions when the contract clause reserves the principal rights to the Government. For example, exclusive rights may be necessary or useful where the government funding of the research is limited to the basic level and a substantial amount of privately financed development is needed to perfect the invention to the point of commercial use. Even where the agency has demonstrated the technical or commercial feasibility of the invention, exclusive rights may be useful where the potential market is small or the industry involved has failed to commercialize the invention. And finally, the granting of such rights may be in the public interest for certain inventions made by the educational and nonprofit institution, which Harbridge House found to be more difficult to develop and put into commercial use. This would especially be true where the institution has an aggressive promotional activity and where the agency does not plan to develop the invention to the point of commercial application.

The Committee is aware that, as Section 1(a) specifically permits the granting of greater rights to identified inventions only when the inventions are not the primary object of the contract, some have

interpreted this to mean that greater rights cannot be granted to identified inventions which are a principal purpose of the contract. Without commenting on the correctness of this interpretation, the Committee believes that insofar as it is correct, the Harbridge House study has demonstrated the need for change. It is precisely these object-type inventions—those directed towards health and public needs—that should be placed in the hands of the public. If exclusive rights are necessary or useful to accomplish this result, then it is more important that the agencies be authorized to grant such rights on these inventions than on inventions which are not a primary object of the contract.

D. SECTION 1(b)—CONTRACTOR ACQUISITION OF TITLE

Section 1(b) provides that in contracting circumstances not within Section 1(a), where the purpose of the contract is to build upon existing knowledge or technology to develop products or processes for use by the Government, as opposed to use for the general public, then the contractor should normally acquire title when he has an established nongovernmental commercial position directly related to the field of the contract.

The Harbridge House findings that can be used to analyze this section are not conclusive. For example, the questionnaire data indicated that the inventions resulting from the research of the mission-oriented agencies are not as directly applicable to commercial uses as are the inventions of some of the public-oriented agencies, and therefore, these inventions often need considerably more technical development to commercialize them than do the public-oriented inventions. Nevertheless, areas were found where there was direct overlapping between government and commercial uses of a few of these inventions. Also, the questionnaire data showed a statistical correlation between increased commercial use of these inventions and the contractor's having both prior commercial experience and exclusive rights. However, during the years studied, most of the contractors had the initial option to acquire title to resulting invention and their choices presumably were based in part on some expectation of commercial value. Thus, there was little, if any, persuasive statistical information to determine whether or not a contractor would have utilized an invention without exclusive rights.

There are other examples of the study results generally supporting the present approach of Section 1(b), although not clarifying all of the areas where specific data was lacking. The case studies indicate, for example, that the greater a prospective contractor's privately sponsored R&D in the field of research directly related both to his commercial position and to the field of work called for by the contract, and the greater his commercial orientation, the greater was the likelihood that he would refuse to participate in government contracting unless he was granted title to the results of this research. However, there was no data that indicated at what point a contractor would refuse any particular contract. Moreover, during the period studied, exclusive rights were given to contractors who were not concerned about patents, their emphasis being upon know-how, systems expertise and the revenues from government work.

On the other hand, the data that was available did not indicate that contractor retention of patent rights typically had adverse effect on competition. This data, however, was not complete, and relied heavily upon the general statement of patentees that they were willing to grant licenses. Also, there was little analysis of the practical conditions of licensing, and one case was indentified where the patent owner, although willing to license his invention, was requesting a royalty rate that users of the invention believed would preclude competition. Furthermore, while only a small number of patents in any one year appeared to have commercial impact, no attempt was made to identify or measure the cumulative effects, if any, that government grant of patent rights in certain fields may have had on competition over an extended period of time.

In view of the lack of specific data regarding some of these questions, the Committee considered the possibility of amending Section 1(b) to limit the circumstances where a contractor would acquire patent rights at the time of contracting to cover only those situations where the data indicated that a participation problem might arise if title were not granted to inventions at the time of contracting. The Committee rejected this alternative, as, on balance, it was concluded that the present approach of Section 1(b) best supports the public interest, taking into consideration all of the data collected, the experience of the agencies to date, and the additional manpower and management effort such a change would require. This conclusion is based on the following considerations:

a. The Harbridge House study clearly showed that the results of research and development directed towards specific governmental and military requirements are generally not as susceptible to commercial uses as the R&D results of the more public-oriented research. The studies also indicated that often the inventive results of this mission-oriented R&D have no direct application to commercial markets, and when they do, considerable technical development is often necessary for their commercialization. Accordingly, inventions resulting from this type of research, in general, appear to need maximum incentives to encourage commercial utilization.

b. The studies also showed that contractors with nongovernmental commercial positions in the field of the R&D effort are normally more likely to commercialize inventions (with or without patent rights), and that these contractors, because of their commercial position and privately financed R&D efforts, are more reluctant to become involved in government-sponsored research unless exclusive commercial rights to inventions are available. Therefore, offering exclusive rights to contractors with commercial positions would provide maximum incentives to encourage these firms to devote their commercial expertise to governmental and military research and development problems, and at the same time, leave rights with a firm that is in a good position to commercialize the inventions. If, however, these contractors fail to use the inventions commercially, the march-in rights of Section 1(f) can be used to force the patent owner to license others.

c. The Committee concluded that for efficient operations of the larger R&D agencies, these agencies should be authorized to determine rights to inventions on the basis of general criteria, normally at the time of contracting, insofar as this can be accomplished without

detrimentally affecting the public interest. Just as it was found that normally the public interest would be served by a general presumption of title in the Government under the conditions, or criteria, of Section 1(a), the Committee believes that the public interest would be served by a general presumption of title in the contractor under the conditions defined in Section 1(b). The Committee believed it would be a heavy burden to require the larger R&D agencies, having thousands of contract actions and reported inventions yearly, to study in detail each such situation unless the public interest absolutely required it.

d. The Committee concluded that on, balance, the public interest would not be detrimentally affected by the general presumption of title to inventions in the contractor in Section 1(b) situations. Although complete studies on the competition issue were not conducted, the information that was gathered indicated that, with few exceptions, contractors owning government-financed patents were willing to license them. In addition, when these inventions were commercialized by either the contractor or his licensee, such action occurred rather quickly—in most cases, prior to the issuance of a patent. As stated, previously, when contractors do not use the inventions themselves they can be required to license others.

Also, the march-in rights of Section 1(g) can be used to require contractors to license others at any time, if the invention is required for public use under governmental regulation or as may be necessary to fulfill health needs. The Committee recommends that Section 1(g) be strengthened to handle other situations that could occur which would detrimentally affect the public interest, as the use of a government-financed invention to eliminate competition in a particular market.

e. And finally, although the studies indicated that there were many patents under contractor ownership which were not being used commercially, the Committee concluded that, on balance, the existence of these patents serve useful purposes, and most detrimental effects they have can be minimized through the use of the march-in rights of Sections 1(f) and 1(g). For example, the patenting of even those inventions which have little or no commercial utility serves to publish and document the technology involved, recognizes the achievement of inventors, and provides defensive protection for government use of the inventions without the Government filing for a patent itself. This latter benefit can be a substantial one to the military departments, as they often procure large quantities of items embodying the results of their research which, if not protected, could result in substantial infringement liability. The alternative would be for the agencies to undertake to patent these inventions themselves, which would require increased staffs to protect a substantial number of inventions presently patented by contractors.

E. SECTION 1(c)—ALLOCATION OF RIGHTS TO IDENTIFIED INVENTIONS

Section 1(c) provides for the allocation of rights to identified inventions on a case-by-case basis in all contract situations not falling under Sections 1(a) or 1(b), except in special situations prescribed by regulation where it would appear to be in the public interest to

permit the contractor to retain rights greater than a nonexclusive license at the time of contracting. Here again, the results of the Harbridge House study appear to support this general presumption, and the exception made to it.

The dominant factors found by Harbridge House which effect the utilization, participation, and competition objectives of government patent policy are taken into account in the criteria of Sections 1(a) and 1(b). These factors include agency mission, the purpose and nature of the contract, the commercial background of the inventing contractor, the state of development of the invention, the size of the potential market, and other similar factors. In contracting situations in which these factors are not found, or are not as obvious, it would seem that a closer imspection should be made of the plans, intentions and capabilities of both the contractor and the sponsoring agency to determine whether government or contractor ownership would best foster commercialization of the invention, and which type of ownership would otherwise best protect the public interest.

However, Section 1(c) recognizes that there may be instances where granting rights at the time of contracting will be in the public interest, even where the criteria of Sections 1(a) and 1(b) are not present. For example, exceptions could be made in appropriate cases for research work undertaken by educational and nonprofit institutions where they have definitive and effective programs for promoting utilization of inventions, and the agency does not. This exception could increase the chances for commercial utilization for the results of this type of research, as the Harbridge House study indicated that the inventive results of these institutions are more difficult to commercialize. Although these institutions do not utilize inventions directly, they are often instrumental in promoting their use when the incentives of exclusive rights are available.

F. SECTIONS 1(f) AND 1(g)

These sections permit the Government to require a contractor to license to others inventions which he owns (a) if the contractor has not taken effective steps to utilize the invention within three years after a patent has issued, or (b) to the extent that the invention is required for public use by governmental regulation, or as may be necessary to fulfill health needs. The Committee believes that the provisions for such march-in rights are both useful and necessary to complete the flexible nature of the overall policy. Just as exceptions are necessary to the title taking categories of Section 1(a) in order to meet exceptional circumstances, the march-in rights provide a type of exception to allowing the contractor to have exclusive rights without limitation.

G. SECTION 2

Section 2 provides that government-owned patents shall be made available and the technological advances covered thereby brought into being in the shortest time possible through education or licensing. The Committee believes that the public interest requires that the results of government-financed R&D be made available in this manner, subject to consideration of national security, using one or more of the

suggested approaches that would best assure widespread commercial use.

The Harbridge House study identified several cases where the Government's promotional efforts and nonexclusive licensing activities were instrumental in obtaining wide adoption and commercial utilization of government-financed inventions. On the other hand, situations were also identified where public-oriented inventions failed to gain commercial acceptance, often because the agency did not completely develop the inventions and industry was not willing to complete them. In some of these cases, it would appear that the granting of some form of exclusive rights might provide the needed stimulus for further development and marketing of these inventions. In some cases, this could be accomplished through the granting of greater rights to the inventing contractor, but in other cases the granting of exclusive rights under government-owned patents would be necessary.

The Federal Council's Patent Advisory Panel is presently considering recommendations for a licensing program which encompasses both nonexclusive and exclusive licensing to promote commercial use of an agency's research results. The Harbridge House findings indicate that both of these licensing approaches should be available for use to provide an agency with the flexibility needed to stimulate commercial utilization under the variety of circumstances encountered.

Part IV—Conclusions and Recommendations

A. CONCLUSIONS

The Committee on Government Patent Policy has concluded that rights to inventions made under government contracts should be allocated in accordance with a flexible, government-wide policy which follows the basic principles and criteria of the October 1963 Presidential Policy Statement, as this Policy Statement is believed to provide the best overall balance of the interests of the public. The Presidential Policy was developed as a result of careful interagency study, and was based on the actual operating experiences of the federal departments and agencies over many years. In addition, the Federal Council has found, based on several years of operating experience, that the Presidential Policy has been effective in bringing about a greater degree of consistency in the patent policies and practices of the federal departments and agencies, and has provided a greater degree of protection of the public interest. This conclusion is also generally supported by the finding of the Harbridge House study, which may be summarized as follows:

(1) The Harbridge House study results conclusively demonstrate that a single presumption of ownership of patents is not in the public interest, applied either government-wide, to a single agency, or to a particular government program.

(2) The Harbridge House study results identify factors which, when properly considered, can affect commercial utilization of government-inventions, participation of industry in government R&D programs, and competition in commercial markets. The most critical factors are:

—the mission of the research sponsoring agency;

—the purpose and nature of the contract;

—the commercial applicability of and market potential for the invention;
—the extent to which the invention was developed by the research sponsoring agency;
—the promotional activities of the sponsoring agency;
—the prior commercial experience of the contractor in the field of the invention;
—the size of the contractor's privately financed R&D in the field of research;
—the contractor's attitude towards and capability to commercially promote the invention; and
—the size, nature and research orientation of the industry that will be using the invention commercially.

(3) The Harbridge House study results and the operating experience of the government agencies indicates that the principles underlying the Presidential Policy, and, with minor exceptions, the criteria established by the Policy for allocating patent rights takes into consideration the above listed factors in a manner which:

—Properly balances the Policy objectives of encouraging utilization of inventions, participation by industry, and commercial competition in the overall public interest;
—Provides the operational flexibility needed by the agencies to accomplish the objectives of their missions under differing contractual situations; and
—Within the differing mission constraints of the federal agencies, promotes consistent application of patent policies and practices in similar contracting situation.

B. RECOMMENDATIONS

In view of the conclusions set forth above, the Committee on Government Patent Policy recommends the continuation of a flexible government-wide patent policy following the basic principles and criteria of the October 1963 Presidential Policy Statement. More specifically, the Committee believes that such a policy should be continued either by making minor modifications to the Presidential Policy (which would be subject to present statutory requirements), or by proposing legislation based on similar principles and criteria which would be applicable to all agencies.

The Committee believes that the recommended changes to the Presidential Policy set forth in Appendix 4 should be adopted at this time. These amendments are based on the results of the Harbridge House study and on the actual operating experience of the agencies under the Presidential Policy.

However, the Committee recognizes that legislation would be necessary to achieve greater consistency in patent policy throughout the Government. Although the Committee has not formally considered proposed legislation, a working group of the Committee has made considerable progress in developing language for a proposed bill covering this policy issue. If legislation is to be proposed, the Committee believes that the results of this effort could be used as a basis for developing an Administration recommendation for legislation.[16]

[16] The results of this work is on file with the Committee, and draws heavily upon the proposed solutions of Senator McClellan's S. 1809 (amended), reported by the Senate Committee on the Judiciary during the 89th Congress, and of Congressman Daddario's H.R. 458, introduced in the 90th Congress.

REPORT OF THE COMMISSION ON GOVERNMENT PROCUREMENT

1972

The Commission on Government Procurement was established by Public Law 91–129 in 1970. The Commission conducted a comprehensive review of all aspects of the Government procurement process and submitted it's findings and recommendations in a 4-volume report in 1972. The chapter covering patents is included here.

REPORT OF THE COMMISSION ON GOVERNMENT PROCUREMENT

1972

PART I.—PATENTS, TECHNICAL DATA AND COPYRIGHTS

CHAPTER 1—INTRODUCTION AND SUMMARY OF RECOMMENDATIONS

Government policies concerning the treatment of patents, technical data, and copyrights in the procurement process have a significant impact on contractors, private innovators, and the general public. Thousands of inventions are made each year by contractors and subcontractors performing under Federal research and development contracts. The disposition of patent rights in these inventions can have important effects on the likelihood they will be perfected and marketed and on the maintenance of competitive markets. Many Government contracts may require the contractor or subcontractor to use inventions covered by private patents. The manner in which the Government uses these patents affects the quality of its programs and the equities of the private patent owner.

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This report examines Government contractual policies concerning intellectual property, with separate chapters devoted to patents, technical data, and copyrights. Based on our findings and conclusions, we recommend a number of changes, many of which require legislation. Hence, we have included draft legislation as appendixes to this report.

Our recommendations are designed to achieve a number of goals which we believe either are not being achieved or are being only partly achieved under present law, policies, and practices. These goals and some of our primary recommendations to achieve them are summarized next.

We believe that the Government's policy should encourage the maximum utilization of inventions made under Government contracts, prevent unjust enrichment of contractors, and foster the reasonable availability of such inventions to the public. The recently revised Presidential Statement of Government Patent Policy is designed to meet these goals, and we believe that policy should be promptly and uniformly implemented so that its effectiveness can be more fully evaluated. In particular the impact of the new exclusive licensing program and liberalization of the granting of contractor rights in identified inventions must be measured. To enhance the chances of the Presidential policy succeeding, we recommend the granting of clear-cut statutory authority to agencies to issue exclusive licenses.

An alternate system developed during our studies is presented. The alternate system calls for Government-wide legislation allowing, as a general rule, the developing contractor or inventor commercial rights in inventions subject to a strengthened system of "march-in" rights under the administration of a central board.

In connection with the use by the Government or its contractors of privately-owned patents, we have found that the bar to injunctions in existing law (28 U.S.C. § 1498) should be retained and expanded to eliminate uncertainty in borderline cases. On the other hand, we believe that greater flexibility is needed by the agencies to waive the bar against injunctions in particular cases as regards specific patents. To achieve these aims, we recommend legislation amending 28 U.S.C. § 1498. We feel it only fair, however, that a patent-owner, having lost the possibility of injunctive relief, should be better assured of obtaining monetary relief. To this end we recommend legislation authorizing all agencies to acquire interests in patents and to settle patent claims and legislation allowing patent suits against the Government in the district courts as well as in the Court of Claims.

Chapter 2—Patents

In this chapter we consider two general aspects to Government policy regarding patents or patentable inventions: rights to inventions made under or during the course of Government contracts and the use by or for the Government of inventions covered by private patents.

Rights in Inventions Made Under Government Contracts

The Government invests some $15 billion per year in research and development programs.[1] A great deal of this is carried on under contracts or grants. During the course of such programs, some 9,000 inventions per year are made by contractors or grantees.[2]

This activity has necessitated the development of policies respecting the disposition of rights in such inventions. Should the Government take all rights to an invention arising under its contract? Or should the contractor/inventor be allowed to retain the commercial rights in the invention, subject to a license in the Government for free use of the invention for Governmental purposes? These are the two generally recognized extremes. In between, a multitude of combinations could be devised. The policy ultimately chosen can have a number of important effects. One is on the probability that the particular invention will be developed to the point of commercial utilization. Another is on the willingness of some organizations to enter into Government contracts, thus affecting the quality or cost of the research effort. Further, patent policy may affect the maintenance of competitive markets. Finally, the costs and practicality of administration of the policy chosen must be considered.

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[1] U.S. Federal Council for Science and Technology, Annual Report on Government Patent Policy, at 43 (1969–70).
[2] Ibid. at 44.

Before examining in detail these factors and our conclusions as to the proper policy that should be followed, it is necessary to explore briefly the nature of patent rights and certain fundamental facts of the invention process.

The Nature of Patent Rights

Article I, Section 8 of the Constitution empowers Congress "to promote the progress of . . . the useful arts, by securing for limited times to . . . inventors the exclusive right to their . . . discoveries." The present patent system has developed in accordance with this authority.

Congress has provided that the "grant" of a patent shall provide that "for the term of seventeen years" the patentee shall have the "right to exclude others from making, using, or selling the invention throughout the United States." [3]

Applications for patents must normally be made by the "inventor" of the invention to be patented, and patents are normally issued to the "inventor." [4] The inventor or patentee can, however, contract away part or all of his rights to others. A myriad of combinations of rights can be sold, licensed, or otherwise disposed of by a patentee. For example, he might issue exclusive or nonexclusive licenses, free or for a royalty, or licenses limited to the use of the invention but not permitting its manufacture or sale. This flexibility of a patentee to dispose of his rights is important in any study of Government patent policy, since it involves the disposition of the patent rights of the inventor (normally, under Government contracts, an employee of a contractor who has agreed to assign his rights to inventions to his employer).

The Nature of the Inventive Process

Not every invention or discovery made can be patented. In accordance with 35 U.S.C. § 101 the invention must be "new and useful." However, it should be emphasized that though an invention is patentable, it may still be far from having been developed to the point where it can be moved into the stream of commerce. Considerable expense and investment are normally necessary to move an invention beyond its patentable stage to a point where it is commercially viable and, hence, available to all. A great deal of engineering effort may be necessary before an item can be produced commercially. And a marketing apparatus and effort will be necessary to make the product's availability known. In some cases the costs of making the invention may be only a small proportion of the total cost of developing the invention into a product useful to the general public. It has been estimated that the cost of bringing the typical invention to the marketplace is ten times the cost of making the invention.[5]

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[3] 35 U.S.C. § 154 (1970).

[4] *See generally*, 35 U.S.C. §§ 111–22 (1970).

[5] U.S. Department of Commerce, "Technological Innovation: Environment and Management," at 8–9. *See also* the Patent Management Subcommittee Report on practice of granting limited exclusive licenses in U.S. Federal Council for Science and Technology, *supra* note 1 at 111.

Underlying the patent system are three fundamental assumptions. First, it is believed that the patent system promotes the making of inventions. Second, it is believed that the system provides the necessary incentives to develop inventions commercially once they are made. Finally, it is believed that the public disclosure required by the patent law promotes scientific and technological knowledge.

Of these three assumed benefits, only one would appear to be significantly affected by Government patent policy—the commercial development of inventions. Public disclosure of inventions made under Government contracts can take place under the contract terms no matter what policy is chosen. The effect on the incentive to invent would also appear minor since the Government, in paying for research and development work, has supplied much of the incentive for invention. In addition, there are many motivations other than the patent system which lead to invention.

On the other hand, Government patent policy can directly affect the degree to which the patent system promotes the development of inventions, once made, to the point of commercial utilization. The exclusivity of the patent system plays an important role in spurring the development of inventions, although there are undoubtedly cases where a particular invention might be commercialized just as quickly without any exclusivity. Effective patent policy must take advantage of the fact that development will normally be promoted by exclusivity; at the same time, it must provide for others to exploit an invention if exclusivity does not produce the desired result of utilization on reasonable terms.[6] We believe that without exclusivity many Government-sponsored inventions would lie dormant, thus benefiting no one. Enterpreneurs would be unwilling to invest in the development of an invention if others could take advantage of their efforts by producing the same product without the initial expenses involved in the creation of markets or developing and demonstrating that the item can be produced economically.

A major point to be kept in mind while weighing alternative Government patent policies is that the patent will be of little benefit to the public if the Government takes the commercial rights but fails to take such additional steps as would be likely to promote the further development of the invention to a commercially usable state. If the Government does not plan either to finance continued development of an item itself or to grant exclusivity of some degree to others, then, in many cases, the possibility for further exploitation of the invention will be significantly reduced.

THE PRESENT POLICY AND ITS EVOLUTION

Policy Prior to the Presidential Policy Statement of 1963

It was not until World War II that inventions developed under contracts became a matter of specific congressional concern. Until that time (and even up to the present in the case of most agencies), this was a matter left to administrative control. After World War II Congress began to take an interest in this area. This interest is reflected in a number of statutes establishing policies for specific agencies or specific

[6] For documentation as to the benefits of generally allowing exclusively to promote utilization, *see* IV "Government Patent Policy Study made by Harbridge House, Inc., for the U.S. Federal Council for Science and Technology, Committee on Government Patent Policy" (hereinafter Harbridge House).

programs within agencies. Congress has not yet, however, established a unified policy in this area. Rather, legislation has been piecemeal and lacks consistency.

One of the earliest instances in which Congress set a patent policy was in the establishment of the National Science Foundation in 1950. At that time, Congress went no further than to provide that each contract of the Foundation should "contain provisions governing the disposition of inventions produced thereunder in a manner calculated to protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed." [7] The first detailed statement of patent policy came as part of the Atomic Energy Act of 1954.[8] This act provides that title to inventions in the field of atomic energy made under AEC contracts vests in the Government.[9] However, the Commission is given the authority to waive these rights in appropriate circumstances. Since the technology and developments in the field of atomic energy had been largely financed by the Government from the outset, Congress felt that the granting of rights to contractors was not necessary to ensure exploitation and development of the inventions. A similar statutory scheme, applicable to all fields of technology, was included in the legislation creating NASA in 1958.[10]

One factor underlying much patent policy legislation is the idea that allowing contractors to retain patent rights in inventions developed under Government contracts is a "give-away." This concept explains the language included in a number of acts related to specific research and development programs that have been construed by some agencies as requiring the taking of title in patents by the Government. As an example of the language commonly employed, the Arms Control and Disarmament Act provides:

> All research within the United States contracted for, sponsored, cosponsored, or authorized under authority of this Act, shall be provided for in such manner that all information as to uses, products, processes, patents, and other developments resulting from such research developed by Government expenditure will (with such exceptions and limitations, if any, as the Director may find to be necessary in the public interest) be available to the general public. This subsection shall not be so construed as to deprive the owner of any background patent relating thereto of such rights as he may have thereunder.[11]

While, as some would argue, the Government may be "giving something away" if it does not exercise its bargaining power to take full title in inventions made under its contracts, the acquisition of full rights by the Government will do the taxpaying public little good without a program of further development. In very few instances does the Government actually provide the additional investment necesssry to move inventions into public use.[12] Likewise, there has been little effort to promote the exploitation of Government-held patents by the issuance of exclusive licenses or other means designed to take advant-

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[7] U.S.C. § 1871(a) (1970).
[8] 42 U.S.C. § 2011 (1970).
[9] 42 U.S.C. § 2182 (1970).
[10] *National Aeronautics and Space Act of 1958*, 42 U.S.C. § 1257 (1970).
[11] 22 U.S.C. § 2572 (1970). Other similar provisions include 7 U.S.C. §§ 427(1), 1624(a) (1970); 15 U.S.C. § 1395(c) (1970); 30 U.S.C. §§ 216(a)(2), 666 (1970); 40 U.S.C. app. § 302(e) (1970); 42 U.S.C. §§ 1954(b), 1961(c)(3), 3253(c) (1970), 50 U.S.C. § 167(b) (1970).
[12] Commonly cited examples of such efforts include TVA work in the fertilizer field and the Department of Agriculture's marketing studies with respect to potato flakes and frozen orange juice, but such efforts are a rarity. *See* Harbridge House, *supra* note 6, at IV–123–124.

age of the main reason for granting these patents in the first place. There have been some recent moves in that direction, discussed more fully below. Such movement may be hampered by a lack of clear-cut statutory authority for each agency to grant exclusive licenses.[13]

Legislation with regard to the allocation of patent rights is far from complete. For instance, no legislation controlling Department of Defense policy in this area has ever been enacted. As a result, DOD and other agencies without statutory coverage developed their patent policies independent of legislative constraints. But administrative approaches prior to 1963 proved as varied as the legislative. DOD followed the so-called 'license" approach, obtaining only a nonexclusive license for governmental purposes in patentable inventions developed under its contracts. The contractor was allowed to retain exclusive commercial rights. Other Government agencies not subject to statutory provisions, such as the Federal Aviation Administration and the Public Health Service, took full rights in patentable inventions.[14]

The Presidential Policy Statement

Recommendation 1.—Implement the revised Presidential Statement of Government Patent Policy promptly and uniformly.

In 1963, the first attempt was made to establish a degree of uniformity in Government patent policy. In that year President Kennedy issued a Statement of Government Patent Policy.[15] This statement, with recent amendments, has provided the framework for Government patent policy. The Armed Services Procurement Regulation patent provisions, for instance, are closely aligned to this policy statement, as are the recently proposed provisions of the Federal Procurement Regulations.

While the Presidential statement did not affect statutory requirements, it was worded to accommodate such legislation as there was. The Presidential statement struck a balance between the "license" and "title" approaches. The statement rejected the concept of a single presumption of ownership, wherein the Government or the contractor acquires title in all the inventions resulting from contract performance. Instead, criteria were provided by which all departments and agencies (not otherwise governed by statute) should allocate patent rights between themselves and contractors.

Under the Kennedy formula, initial determination of patent rights is usually made at the time of contracting. Normally, the Government takes exclusive patent rights if the principal purpose of the contract (1) is to develop products for use by the general public, or (2) is directly related to public health or welfare, or (3) is for work in a field of technology basically developed by the Government and exclusive rights might lead to contractor dominance of the field, or (4) is for the operation of a Government-owned facility. In other cases, the contractor may retain exclusive patent rights at the time of contracting if the subject matter of the contract is directly related to an area where the contractor has an established commercial business. When the contractor does not obtain exclusive patent rights at the time of contracting, disposition of patent rights is considered on a

[13] See the Memorandum of the Assistant Attorney General, Office of Legal Counsel, dated Sept. 18, 1967; U.S. Federal Council for Science and Technology, *supra* note 1 at 120–23.

[14] For a history of the development of Government patent policy generally, *see* R. Nash and J. Lasken, "Patents and Technical Data," Government Contracts Monograph 10.

[15] Presidential Memorandum and Statement of Government Patent Policy, 28 Fed. Reg. 10943 (1963).

case-by-case basis, after the inventions have been identified and reported to the Government. The main criteria governing this disposition of rights concern the nature of the invention and the plans and intentions of the contractor to market the invention.

When the contractor retains exclusive patent rights, the Government reserves a royalty-free license to practice the invention for any governmental use. The Government also reserves the right to require the contractor to license others to protect the public interest in the health area and to make the invention accessible if the contractor fails to take effective steps to commercialize or license the invention. These are commonly referred to as "march-in rights."

President Nixon, in August 1971, issued a new Memorandum and Statement (reproduced in Appendix C) which is substantially in accord with the 1963 statement except that several revisions to encourage utilization have been made.[16] He reaffirmed the need for flexible, Government-wide policies designed to protect the public interest. The Nixon revisions, based on a study of patent policies by the Federal Council for Science and Technology, attribute the degree of commercial utilization of Government-sponsored inventions, commercial competition, and participation of industry in Government research and development to several important factors. These include the mission of the contracting agency; the purpose and nature of the contract; the commercial applicability and market potential of the invention; the extent to which the invention is developed by the contracting agency; the promotional activities of the contracting agency; the commercial orientation of the contractor; the extent of his privately financed research in the related technology; and the size, nature, and research orientation of the pertinent industry.

One group of revisions to the Presidential policy concerns the granting of greater rights to contractors in identified inventions, even though at the outset the Government acquired principal rights. The Kennedy statement provided that such greater rights could be given only if "the invention . . . is not a primary object of the contract." This was changed as a result of the problems experienced by agencies such as the Department of Health, Education, and Welfare and the National Aeronautics and Space Administration under the previous policy. Another change allows after-the-fact granting of greater rights where "the Government's contribution to the invention is small compared to that of the contractor." This change appears to be designed to assist in those cases where firms may be reluctant to enter into research contracts for fear of jeopardizing their background positions. Lastly, new language was added providing that where the invention is not a primary object of the contract, greater rights may also be granted to the contractor under specified criteria. According to the Federal Council for Science and Technology these criteria are "less stringent" and "would create the greatest likelihood that the invention would be developed and put into commercial use." [17]

The second major change places emphasis on licensing of Government-owned inventions. The General Services Administration is

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[16] Presidential Memorandum and Statement of Government Patent Policy, 36 Fed. Reg. 16887 (1971).

[17] U.S. Federal Council for Science and Technology, *supra* note 1, at 155.

charged with developing regulations to promote the availability of and development of Government-owned inventions. For the first time, exclusive licensing is specifically mentioned as one means of accomplishing this. It will take several years to evaluate the effectiveness of this policy in promoting utilization.

Based on our assessment of current law and practice, we have concluded that any substantial changes in the law and policies in this area should await further assessment of the actual experience under the revised Presidential Statement of Government Patent Policy. We do believe that some minor changes are needed, and that continued emphasis should be placed on executive agency implementation, with policy review by the Committee on Government Patent Policy established under the Federal Council for Science and Technology.

Need to Evaluate the Presidential Policy

The recent changes to the Presidential policy were designed to overcome several shortcomings in that policy. Whether, in practice, these changes will fulfill their purpose remains to be seen, but we feel it is premature to disturb this latest effort by the President to achieve a more workable patent policy. Much thought and expertise have gone into the drafting of the Presidential policy. This should not be dismissed lightly. Any major departures in the patent rights area should be deferred until the revised policy has been evaluated by the Federal Council for Science and Technology in the light of actual agency experience. This evaluation should be made in such a way as to take into account and evaluate the factors discussed below.

Need for Prompt and Uniform Implementation of the Presidential Policy

In order to allow an adequate evaluation of the Presidential policy, it is important that it be promptly and uniformly implemented by the agencies. At the time of preparation of this report, most agencies had not published regulations or revised their regulations in accordance with the Presidential policy. We urge that they do so. Efforts are underway to develop uniform regulations for use by most civilian agencies through the Federal Procurement Regulations. This is a step in the right direction.

Some agencies cannot, because of statutory provisions, adhere completely to the Presidential policy. In most such cases, these agencies are required to follow a so-called "title policy." [18] To allow truly Government-wide implementation of the Presidential policy and any future modifications of it, we believe that inconsistent legislation should be appropriately amended or repealed. [19]

Exclusive Licensing

Recommendation 2.—Enact legislation to make clear the authority of all agencies to issue exclusive licenses under patents held by them.

One of the potentially most significant aspects of the revised

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[18] One statute, the Solid Waste Disposal Act, requires adherence to the 1963 statement. 42 U.S.C. § 3253(c) (1970).

[19] Section 14 of the draft legislation at Appendix A could be used as a guide as to the legislative action necessary. However, some of the provisions amended or repealed in section 14 are of sufficient flexibility to allow adherence to the Presidential policy and, hence, would not have to be amended in order to allow uniform implementation of the Presidential policy as it presently reads.

Presidential policy is the new emphasis on exclusive licensing. As discussed previously, it appears that there is some confusion as to the exact scope of the authority of the individual agencies and the General Services Administration to grant exclusive licenses. We believe uncertainty in this area could interfere with the effectiveness of the exclusive licensing program. Accordingly, we favor legislation granting agencies clear-cut authority to issue exclusive licenses.

Section 12 of the draft bill at Appendix A to this report could serve as a model for such legislation. However, that section is drafted in broad terms without any guidelines limiting the authority granted. We wish to emphasize that this does not mean that we either oppose or favor the inclusion of statutory guidelines. Since our study efforts did not encompass this question, we are not in a position to take a meaningful position. Our main point is simply that clear statutory authority to grant exclusive licenses is needed.

March-In Rights Under the Presidential Policy

Recommendation 3.—Supplement the Presidential policy by the adoption of uniform procedures for application of the rights reserved to the Government under the policy.

There is one area of the Presidential statement that could use additional and immediate supplementing—the procedures for the administration of its march-in rights provisions. Based on figures assembled by the Federal Council for Science and Technology it does not appear, at least through 1970, that the march-in rights retained by the Government have ever been exercised.[20] This could be accounted for by a variety of explanations, one of which is that before the early 1970's there were few, if any, inventions old enough to be subject to march-in provisions as required by the Presidential policy. In the coming years, this will no longer be the case. Moreover, the apparent trend toward increased research in nonmilitary areas, coupled with the increased opportunities under the revised policy for civilian agency contractors to obtain greater rights in inventions, could lead to greater need for the exercise of the Government's march-in rights. That is, more inventions of direct commercial value may be made in the future. The new emphasis on cancer, automobile safety, and environmental research exemplifies what appears to be a reordering of priorities toward the civilian sector of the Government.[21]

The Presidential policy supplies no real guidance as to the mechanics of implementing its march-in rights provisions. Many of the civilian agencies, with minimal staffing and expertise in the patent law area, will be left to devise their own procedures. This could lead to, at worst, no implementation and, at best, inconsistent implementation. Efforts should be undertaken immediately to develop regulations and procedures to be followed by all agencies in implementing the march-in provisions of the Presidential policy.

Possible Weaknesses of the Presidential Policy

Reservations have been expressed as to whether the Presidential policy is the optimum policy. A system which generally allows con-

[20] U.S. Federal Council for Science and Technology, *supra* note 1 at 94–95.

[21] Statistics prepared by the Federal Council for Science and Technology show that generally the total funds obligated for R. & D. by the civilian agencies has been rising and that DOD's share of the total dollars obligated for R. & D. has been decreasing. Ibid.

tractors or inventors to obtain commercial rights subject to a strengthened march-in rights procedure under the control of a central board may hold greater promise of fulfilling the goals of patent policy. However, these reservations should await the test of actual experience.

Experience may prove the Government should not routinely take principal rights in all of the situations listed in section 1(a) of the Presidential policy. This is particularly true with respect to contracts which have as a principal purpose exploration into fields which directly concern the public health, safety, or welfare. It is not clear why the incentives needed for further development of products in these fields are any different than those needed in others,[22] although the need for safeguards in these areas is clear.

The Presidential policy relies on deferred determinations and the granting of greater rights in identified inventions. Reliance on deferred determinations and after-the-fact disposition of patent rights has several potential shortcomings, particularly as a greater share of the Government's research funding goes into research contracts falling within section 1(a) of the Presidential policy, which requires the Government to take principal rights at the outset. These shortcomings include deferred utilization, increased administrative costs, and a lessening in the willingness of some firms to participate in Government research work.

The uncertainty of ownership involved in a deferred determination policy may discourage some particularly competent contractors from participating in Government programs. A contractor whose privately-financed background position might be jeopardized by newly-generated inventions made under a contract might decline to enter into such a contract if he were unsure of obtaining exclusive rights in the inventions. His refusal to participate would probably result in the use of a less qualified contractor at a greater cost. Admittedly such cases would be relatively isolated and rare. It is also true that the Presidential policy attempts to overcome this problem somewhat by allowing the waiver of section 1(a) in exceptional circumstances. We believe that experience under the Presidential policy should be noted with particular care in evaluating the overall efficacy of the policy.

More importantly, the long processing periods inherent in a deferred determination policy will often delay prompt development and utilization of Government-sponsored inventions, since a participating contractor would wish to establish his rights before investing his risk capital.[23] Utilization could also be adversely affected by the administrative burden of petitioning the Government for exclusive commercial rights and the probable requirement that the contractor file patent applications to protect the property rights during the petition period. These tasks may destroy contractor interest in inventions that appear economically marginal on first review.

Finally, increased administrative costs to both the contractor and the Government for the drafting, submission, and review of petitions

[22] For example of the problems which can be created, *see* U.S. Comptroller General, Report B–164031(2), "Problem Areas Affecting Usefulness of Results of Government-Sponsored Research in Medicinal Chemistry," Aug. 12, 1968. *See also* Harbridge House, *supra* note 6.
[23] Harbridge House, *supra* note 6, at II–47–60.

on a case-by-case basis may prove out of proportion to the results achieved by placing reliance on after-the-fact determinations.

The cost of administering an exclusive licensing program may prove high. Where a patent has a commercial potential, a costly and time-consuming proceeding would have to be held to determine which company or companies would be granted rights in the invention. It seems certain that a hearing with appropriate notice, as is outlined in the proposed GSA licensing regulations, would be required. It is questionable whether many agencies have sufficient manpower to carry on active licensing programs. In many cases the licensee, if any, will be the original contractor/developer since he will have a jump on others in terms of the technical know-how behind the invention.[24]

AN ALTERNATE APPROACH

If evaluation of experience under the revised Presidential policy indicates a need for further policy revisions, we urge consideration of an alternative approach generally allowing contractors to obtain commercial rights but subjecting these rights to a strengthened "march-in" procedure. Such an approach was developed in detail and recommended by our Study Groups and staff during the study phase of our activities.

The alternate approach involves the repeal of all existing legislation concerning the disposition of rights in inventions made under Government contracts. This legislation would be replaced by a statute of Government-wide application. We believe uniformity is practical and desirable. Since this alternate policy is not compatible with current legislation, repeal of that legislation would be necessary. New positive legislation would be needed, as it would be difficult to implement the alternate approach on a strictly administrative basis.

In presenting this alternate approach, we recognize the dilemma involved. The path to comprehensive patent policy legislation is fraught with obstacles. Experience indicates that a broad patent statute is extremely difficult to enact, as shown by unsuccessful efforts in past years.

We have not proposed a time limit for testing the efficacy of the Presidential policy. Wide differences of opinion as to how well it is working may make assessment difficult.

The primary purposes of the statutory alternative are to establish (1) a stronger policy of promoting the commercial exploitation of patentable inventions arising under Government contracts; (2) greater uniformity in Government agency execution of this policy; and (3) a special board to administer the Government's march-in rights. Enactment of a general statute would require the repeal of existing statutory provisions applicable to the Atomic Energy Commission, the National Aeronautics and Space Administration, and several other Government agencies. These existing provisions reflect a desire to prevent monopoly control or undue private enrichment in the use of inventions made possible by public expenditures. We believe that a new general statute, if enacted, should take explicit account of such concern.

[24] A few agencies have already initiated exclusive licensing programs. One of these is HEW. Under its program the only exclusive license issued to date went to the developing contractor. *See* Drug Research Report, vol. 14, No. 15, Apr. 14, 1971.

The terms of the legislation should strike a reasonable balance between the public and private equities involved and recognize the multiple values embodied in the public interest. The public will benefit from a patent policy which not only promotes commercial applications of the patents, but also insures maximum public benefits from the expenditure of public funds.

The alternate approach reflects reservations which have been expressed with the requirement of the Presidential policy that the Government take principal rights in each of the four classes of situations listed in section 1(a). The alternative would allow the contractor or inventor commercial rights at the outset except in two situations where it appears that the granting of commercial rights to contractors would not promote or be necessary to promote utilization. The first such situation is where it is the intention of the Government to fund the inventions made under a contract to the point of commercial application. Here there is no real need or equity in allowing the contractor to obtain commercial rights. Secondly, if the contract is with an educational or other nonprofit organization utilization would not be fostered by granting the contractor title unless it was determined that inventions likely to flow from a given contract will be promoted in a manner consistent with the objectives of utilization and maintenance of competition.

Another situation under the Presidential policy where the Government normally takes title at the time of contracting is where it is expected that use of inventions will be required by Federal regulation, as might be the case, for example with research into improved antipollution devices for automobiles. In such cases, there would be no need for patent incentives to ensure utilization. It is unlikely that the inventions that may fall out of a particular research effort will later be required for use by regulation. Accordingly, under the alternative policy, this would not be the basis for the Government to take commercial rights in inventions. Instead the Government "march-in" rights would apply in such situations. The "march-in" rights procedures under the alternate policy are developed more fully below.

In all cases, the Government would retain, as it presently does, a royalty-free, nonexclusive license for use of the invention for governmental purposes. In return for allowing contractors to generally obtain exclusive commercial rights; and in lieu of a policy placing primary reliance on deferred or after-the-fact determinations and exclusive licensing, the alternate policy would establish a strengthened system of march-in rights, including, possibly, the recovery of governmental investment, to safeguard the public interest. Safeguards would be built into the policy to ensure that utilization does occur, that it occurs on reasonable terms, and that the public's equity in the invention is recognized.

As part of the alternate approach, a central agency would be established and designated the "Government Patent Review Board," to administer the march-in rights retained by the Government. The Government, through the Board, would retain the right to require compulsory licensing of inventions made under its contracts (1) after the contractor had been given a reasonable opportunity to develop the invention commercially and had failed to do so, and (2) where he had developed the invention, but refused to either sell or license it on

reasonable terms. The current Presidential policy would apply to inventions necessary to fulfill health or safety needs or required for use by governmental regulations. Thus, there would be no time limit on the exercise of the Government's march-in rights in such cases.

The Board would also be empowered to revoke all rights of the contractor if he (1) failed to disclose an invention promptly, (2) supplied materially false information concerning the invention, or (3) used the patent on the invention in such a way as to violate the antitrust laws.

Consideration could be given to developing a mechanism to prevent unconscionable profits on inventions made under Government contracts. The Board could be empowered to require payments to the United States from the contractor out of any profits on an invention so as to recognize the relative equities of the public and the contractor. However, there are many difficult problems to be worked out in developing such a mechanism, and there are no such provisions in the draft legislation at Appendix A.

Initially, the Board's workload would be minimal since it would be some time before patents subject to the Board's jurisdiction would begin to be issued. To fill this initial void, the Board could be assigned responsibility for the development of implementing rules and regulations under such legislation as is enacted to implement the alternate approach. The Board could take the lead in coordinating efforts to develop uniform contractual clauses and procedures. Possibly, also, the Board could be assigned responsibilities in the related area of Government employee inventions, since many of the policy considerations and the need for "march-in" rights appear to be analogous. As this phase of patent policy, presently governed by Executive Orders 10096 [25] and 10930,[26] is beyond the scope of our charter, we have not conducted any studies in this area.

Consideration was given to the placement of the Board within the framework of an existing agency such as the Department of Commerce. Due to the rather narrow scope of its functions and its primarily quasi-judicial function, this was felt impractical.

Use of Patented Inventions by or for the Government

A second major area of concern with respect to Government policy centers on the infringement of privately held patents by the Government or its contractors or subcontractors. For example, the Government may award a contract for the design and production of a piece of electronic equipment. The most effective way of designing and producing the equipment may require the use of a particular item or process covered by a patent belonging to a third party who has licensed neither the Government nor the contractor.

BACKGROUND

Legal Remedies for "Infringement" by or for the Government

Normally, a patent owner may sue for damages *and* to enjoin the infringement of his patents by others. However, where a patent is

[25] 3 CFR, 1949–43 Comp., at 292.
[26] 3 CFR, 1959–63 Comp., at 456, Executive Orders 10096 and 10930 are included in the notes to 35 U.S.C. ch. 27 (1970).

being used "by or for" the Government, the patent holder's only remedy in most cases is suit against the United States in the Court of Claims for money damages. A suit directly aganist an infringing Government contractor either for money damages of injunctive relief is not available if the patented invention is being used by the contractor with the "authorization and consent" of the Government. This result obtains from the provisions of 28 U.S.C. § 1498(a), which reads, in part, as follows:

> Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the Court of Claims for the recovery of his reasonable and entire compensation for such use and manufacture.
>
> For the purposes of this section, the use or manufacture of an invention described in and covered by a patent of the United States by a contractor, a subcontractor, or any person, firm, or corporation for the Government and with the authorization or consent of the Government, shall be construed as use or manufacture for the United States.

There are, in addition, a few other statutes of limited application which provide judicial remedies for misuse of patents by the Government. These include the Invention Secrecy Act,[27] the Atomic Energy Act of 1954,[28] the Foreign Assistance Act,[29] and the Tennessee Valley Authority Act.[30] These provisions do not significantly impact on the development of our primary recommendations.

The basic philosophy of 28 U.S.C. § 1498(a) is that Governmental programs should not be interrupted or delayed by injunctions granted in patent infringement actions. Money damages are considered an adequate remedy in such cases.

The history of 28 U.S.C., § 1498 illustrates this underlying philosophy. In 1910, legislation was passed which for the first time waived the Government's sovereign immunity with respect to patented inventions "used by the United States." [31] In 1911, the Supreme Court, interpreting this Act, refused to enjoin the manufacture of patented guns by the Army in its own arsenals.[32] However, in 1918 the Supreme Court ruled that the Act did not provide Government contractors with immunity from suits to enjoin their infringements.[33] As a direct result of this decision, legislation was enacted which provided an exclusive remedy of suit in the Court of Claims to recover "reasonable and entire compensation" when a patented invention was "used or manufactured by or for the United States" without license. [34]

The next major development in the evolution of 28 U.S.C. § 1498(a) was the addition of language making the statute applicable to infringement by the contractor only where the use of the invention was with the "authorization and consent" of the Government. This language first appeared in the Royalty Adjustment Act of 1942 [35] and was incorporated into title 28 in 1951.[36]

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[27] 35 U.S.C. § 182 (1970).
[28] 42 U.S.C. § 2187 (1970).
[29] 22 U.S.C. § 2356 (1970).
[30] 16 U.S.C. § 831(r) (1970).
[31] Act of June 25, 1910, ch. 422, 36 Stat. 851.
[32] *Crozier* v. *Krupp*, 224 U.S. 290 (1911).
[33] *Crump & Sons* v. *Curtis Turbine Co.*, 246 U.S. 28 (1918).
[34] Act of July 1, 1918, ch. 114, 40 Stat. 705.
[35] Ch. 634, 56 Stat. 1013.
[36] Act of Oct. 31, 1951, ch. 655, sec. 50(c), 65 Stat. 727.

The Granting of Authorization and Consent

The granting of authorization and consent precludes injunctive action against Government contractors for patent infringements. It has been the policy of most Government agencies to include a rather broad authorization and consent provision in contracts calling for research and development work. DOD, for instance, uses the following provision, which is also used by NASA[37] and the Department of Transporation:[38]

AUTHORIZATION AND CONSENT (JAN. 1961)

> The Government hereby gives its authorization and consent for all use and manufacture of any invention described in and covered by a patent of the United States in the performance of this contract or any part thereof or any amendment hereto or any subcontract hereunder (including any lower-tier subcontract).[39]

A somewhat more limited clause is used in supply contracts. The DOD clause reads as follows:

AUTHORIZATION AND CONSENT (MAR. 1964)

> The Government hereby gives it authorization and consent (without prejudice to any rights of indemnification) for all use and manufacture, in the performance of this contract or any part hereto or any amendment hereto or any subcontract hereunder (including any lower-tier subcontract), of any invention described in and covered by a patent of the United States (i) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract, or (ii) utilized in the machinery, tools, or methods the use of which necessarily results from compliance by the Contractor or the using subcontractor with (a) specifications or written provisions now or hereafter forming a part of this contract, or (b) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.[40]

A similar clause is also used by NASA[41] and DOT.[42]

As indicated earlier, even if authorization and consent is not given by way of the above clauses, it may still be implied. Numerous factors,

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[37] NASA PR 9.103.
[38] DOTPR 12–9.6106–2.
[39] ASPR 9–102.2.
[40] ASPR 9–102.1.
[41] NASA PR 9.103.
[42] DOTPR 12–9.6105–1.

such as knowledge by the contracting officer or other Government official of the use of a patented invention by the contractor and the lack of objection to such use, have been described as indicating that the Government's authorization and consent was given by implication.[43]

The Comptroller General has ruled that an agency cannot expressly withhold authorization and consent with respect to particular procurements or patents.[44] This ruling was made in response to a protest over the inclusion of a provision in a request for proposals of the Atomic Energy Commission which specifically withdrew the Government's authorization and consent to infringe upon two privately held patents. One was a product patent and one was a process patent.

The Comptroller General reasoned that the inclusion of such a clause would require proposers to include "contingent costs in their bid prices for fear of having to defend infringement suits which would not occur but for the subject clause, and of having to bear the consequences of possible contract termination due to injunction." [45] However, the decision was not based on policy grounds. Rather, it was concluded that, as a matter of law, a contracting officer has no authority, except in limited situations, to withhold authorization and consent. The AEC clauses were deemed "legally ineffective." [46] This conclusion was based on a detailed analysis of the history of 28 U.S.C. § 1498.

The Comptroller General ruled that authorization and consent could not be withheld as to any product patent where the specifications called for such item to be embodied in the final item, or as to patents covering processes unless "conditioned by language to the effect that the withholding of consent to its use applies only if . . . such use is not economically or reasonably necessary to manufacture the article specified in the contract." [47]

Indemnification

Even where authorization and consent is granted, the Government may still wish to require the contractor to indemnify it for any liability the Government incurs pursuant to 28 U.S.C. § 1498. While 28 U.S.C. § 1498 bars injunctive action, it is not interpreted by the Government as preventing the shifting of ultimate financial liability. For this purpose, patent indemnity clauses are included in many Government contracts.

Practices vary somewhat, but indemnification is generally not required in research and development contracts, though it is normally obtained with respect to supply contracts. Where a contract contains a mix of R&D and supply requirements, indemnity may be used. The AEC provides the most complete set of instructions for tailoring the patent indemnity provisions to acommodate a mix of R&D and supplies.[48] Contracts of the military departments for weapons systems usually do not include patent indemnity clauses, even though standard commercial components may be involved. At one time the ASPR included an indemnity clause which was limited to standard commercial items. This clause was so difficult to administer that it was deleted from the ASPR.

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[43] R. Nash and J. Lasken, *Patents and Technical Data*, Government Contracts Monograph No. 10, The George Washington University (1967), at 87–88.
[44] 46 Comp. Gen. 227 (1966).
[45] *Ibid* at 242.
[46] *Ibid.*
[47] *Ibid.*
[48] AECPR 9–9.5010.

The ASPR differs from most other regulations in that it specifically negates the applicability of Uniform Commercial Code-type implied warranties against patent infringement. The "Authorization and Consent" clause of ASPR 9–102.1, in part, states:

> The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clauses, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

Section 2–312 of the Uniform Commercial Code, in part, states:

> (3) Unless otherwise agreed to seller who is a merchant regularly dealing in goods of the kind warrants that the goods shall be delivered free of the rightful claim of any third person by way of infringement or the like but a buyer who furnishes specifications to the seller must hold the seller harmless against any such claims which arises out of compliance with the specifications.

The Department of Justice has given some indication that it would rely on commercial warranties alone or as a supplement to express contractual warranty or indemnity provisions, in order to attempt to bring contractors before the Court of Claims as third party indemnitors in patent suits against the Government.[49]

There is evidence that in some cases, despite the inclusion of indemnity clauses in contracts, contractors have avoided liability for infringement. The cost to the Government of bringing suit against uncooperative contractor/indemnitors may result in their avoiding full indemnification.[50]

Administrative Settlements

There are some alternative methods of limited scope available by which a patent owner can receive compensation for the use of his patents without resorting to suit under 28 U.S.C. § 1498. The AEC and NASA have, by statute, special boards which may grant compensation for patent infringement in some cases.[51] An administrative remedy is available from the military departments, which rely on 10 U.S.C. § 2386 for their authority in this area. NASA and the AEC also have similar authority in this regard, though not quite as clearcut as that of DOD.[52] Finally, NASA has developed a procedure known as "Preprocurement Licensing," though this has rarely been used.

As indicated above, an administrative claim procedure is not available to a patentee with respect to all Government procurements. In many instances, a patentee is required to sue in the Court of Claims in order to obtain redress for the unauthorized use of his patent by the Government. The General Services Administration expends millions of dollars on supplies and services each year. Yet, no authority has been vested in GSA to negotiate or settle, prior to suit, any alleged patent infringement arising in its procurements, regardless of the

[49] Expression of such intent is found in the following language in a letter from the Civil Division to an electronics manufacturer in connection with *Technitrol, Inc.* v. *U.S.*, F.2d 1362 (Ct. Cl., 1971), which stated: ". . . Even where there may be no express indemnity obligation, the Government in some situation may take the position that there is an implied indemnity under the Uniform Commercial Code or other applicable laws . . ."

[50] ASPR 9–408 provides, ". . . settlement of claims involving payment for past infringement shall not be made without the consent of, and equitable contribution by, each indemnifying contractor involved, unless such settlement is determined to be in the best interests of the Government and is coordinated with the Department of Justice with a view to preserving any rights of the Government against the contractors involved. If consent of and equitable contribution by the contractors are obtained, the settlement need not be coordinated with the Department of Justice."

[51] 42 U.S.C. § 2187 (1970), AEC; and 42 U.S.C. § 2457 (1970), NASA.

[52] 42 U.S.C. § 2201(g) (1970), AEC; 42 U.S.C. § 2473(b)(3) (1970), NASA.

merits. As a result, administrative claims procedures are not universal and are limited by statute and practical application to but a few sectors of Government procurement. Some of the more significant of these are discussed next.

DOD Administrative Claim Procedures

The Department of Defense administrative claim procedure is an informal procedure for processing an administrative claim for patent infringement against the military agencies. This procedure, while broad enough in scope to encompass licensing prior to procurement, in practice involves settlement for past infringement, with or without a license for further infringement.

The existing statutes are silent as to what essentials must be present to constitute a "claim." 35 U.S.C. § 286 (1970) provides that running of the six year statute of limitations in the U.S. Court of Claims will be stopped if a "written claim" has been received by an agency. Therefore, DOD has adopted a set of rules [53] to govern action in the receipt, investigation, and settlement of such claims. The rules for presentation of a claim are minimal and can be met by the patentee without the need of legal counsel.

Upon receipt of a claim, the agency begins what is effect is an *ex parte* proceeding, the extent of which may be dependent upon whether patent indemnification is involved. The agency may then initiate an extensive investigation into the merits of the allegation including an infringement study, a patent validity study, if warranted, and other appropriate investigations, including a review of contract records for determinations of license rights in the Government.

If infringement is clearly establishable, the validity of the patent reasonably certain, and the amount involved reasonably determinable and available from existing appropriations, the administrative claim procedure may result in satisfactory settlement. In 1970, the Air Force disposed of 39 patent claims by denial or settlement. Of these, seven were settled. It took an average of two years and five months to reach each settlement. In addition to the 39 disposals, another 26 potential claims were disposed of in 1970 because the claimant failed to complete his claim or for other reasons.[54]

One aspect of the administrative settlement process that is worthy of note is that in many cases where a claim is made against the Government for the unauthorized use of an invention by a Government contractor, the contractor may bear ultimate liability via an indemnity clause. Hence, after a tentative settlement agreement between the patent owner and the Government has been reached, the Government has to determine whether the indemnitor/contractor or contractors will pay their proportionate shares. If they will not, the Government may decide to deny the claim, rendering the entire process fruitless. This leaves the patent owner with two alternatives. He can accept the agreed-upon sum less the indemnitor's portion (which may be the major portion), or he can file suit. However, a Government refusal

[53] ASPR 9–404. These procedures are used extensively. Task Force 2 of our Study Group 6 found that 240 claims were pending in the Department of Defense during May 1971. *See* Task Force No. 2 Report to our Study Group 6, at C–5.

[54] *See* Task Force No. 2 Report to our Study Group 6, at C–6.

to settle is rarely based solely on the refusal of the contractor/indemnitor to agree to the settlement.[55]

Patent Compensation Board

A second alternative to litigation to enforce the patent rights of an individual is the Patent Compensation Board of the Atomic Energy Commission. Obviously, this procedure is of limited use. Under the Atomic Energy Act of 1954, the Commission may declare certain patents to be affected with the public interest and thereby provide for the compulsory licensing of such patents in the atomic energy field.[56] The procedure also covers claims for awards for use of an invention in the atomic energy field even though not declared affected with the public interest. The proceedings before the Patent Compensation Board therefore are not solely in the nature of a patent infringement procedure, but rather are for the grant of an award. The questions of infringement and validity are presented and do enter into the consideration of such an award. The proceedings entail the filing of formal briefs and the taking of testimony with cross-examination. Due to the nature of the proceedings, much time, effort, and presumably money are expended by both Government and patentee to reach a satisfactory accord.

"Preprocurement Licensing"

Another alternative is the preprocurement licensing procedures of the National Aeronautics and Space Administration.[57] Briefly stated, this procedure provides that if a privately-owned patent which will be infringed by a specific procurement meets certain requirements of enforceability and commercial acceptance, NASA may take a license under the patent, effective only for the identified procurement, and consider the royalty in evaluating competing bids. In the event an unlicensed bidder is awarded the contract, the patent owner will receive the royalty payment from NASA.[58] An expedited procedure for obtaining patent licenses before the infringing acts occur is required by this policy. This differs from the policies of other agencies, where privately-held patents are ignored in procurement award and reliance is placed on the consideration of infringement claims many years later as the normal method of compensating patentees.

The preprocurement licensing procedure, while favorably accepted by industry, has received little actual use by NASA because of the R&D nature of NASA procurement.[59] Preprocurement licensing has been considered for adoption by other agencies, but has not been accepted either because of the lack of statutory authority to purchase licenses in patents, the lack of trained patent personnel to evaluate in-

[55] For instance, the Task Force No. 2 Report to our Study Group 6 reported, at B–18, that of approximately 80 administrative claims reviewed by the Defense Supply Agency, only one was denied solely on the basis of refusal of the indemnitor to contribute what was considered to be equitable. This unpublished report is part of the Commission's files.

[56] 42 U.S.C. § 2183(a) (1970).

[57] NASA PR 9.102 (Rev. 4, 1970 Ed.).

[58] For the GAO's reaction to and comments on the NASA policy, *see* 46 Comp. Gen. 206 (1966), and Comp. Gen. Dec. B136916 (Apr. 15, 1968, and May 28, 1970). For a detailed discussion of the background to the development of NASA's policy, *see* Mossinghoff and Allnutt, "Patent Infringement in Government Procurement: A Remedy Without a Right?" 42 *Notre Dame Law Review* 5 (1966).

[59] NASA's revision to its preprocurement licensing policy limited its applicability in the research and development area to those R. & D. contracts wherein the delivery of hardware or the use of a specific process is contemplated at the time the proposals are solicited (NASA PRD No. 70–14, Nov. 2, 1970).

fringements, the probable burdens involved in this expedited procedure, or the effect of this procedure on the use of patent indemnity provisions.[60]

THE UNDERLYING CONSIDERATIONS AND ISSUES INVOLVED

Two factors must be considered in arriving at a sound policy in this area. First is the extent to which the Government or its contractors should be free to avoid the normal consequences of patent infringement and, in particular, injunctive relief against infringement. The second is whether policies which discount the rights of patent owners will tend to discourage invention, especially invention related to Governmental needs.

Allowing injunctive relief against Government contractors could disrupt Government programs. Where a patent is vital to the performance of the contract, it would tend to limit competition to the patentee or those whom he chooses to license. In some cases the Government would be forced to use a high-cost producer rather than a low-cost producer simply because the former controlled a patent vital to only one subsystem of the entire item. We believe these are real and important considerations that form a backdrop to any recommended policy.

We are less impressed with the arguments that failure to recognize private patent rights will make private parties unwilling to risk their own funds, time, and effort in the development of products to fulfill a governmental need. While there may be such an effect, it is highly problematical. In the first place, the immediate effect of the particular policy chosen is not on future invention, but on the rights of current patentees. Certain policies would improve their bargaining positions vis-a-vis the Government or its contractors or potential contractors. Others will weaken their positions. In any case, it is a fact that the invention under dispute has already been made.

The question that remains, then, is to what extent Government policy in this area can influence future invention and innovation. We believe that the possible patent protection a company will obtain with respect to inventions it might develop from its own research and development effort aimed exclusively at the Government market is, at most, but one factor out of many bearing on the decision to engage in the research. If the research also has potential commercial application, this factor becomes even more diluted. Further, where the particular company or division of the company is already directly involved in Government contracting or subcontracting, it would seem that patent protection would become an even more minor factor.

The fact that we discount the argument that Government policy in this area plays a significant role in the incentives for development of inventions does not mean that we reject completely the idea that it has some effect. We merely wish to emphasize that this effect is insufficient to overcome the need for maintaining an atmosphere where Government procurement can proceed without costly interruptions. However, we see no sound reason why an atmosphere cannot be created which would give greater assurance to patent holders that they will be compensated for their efforts and not put at a disad-

[60] *See* ASPR case No. 66–196 and 68–148 and Comp. Gen. Dec. B162385 (Nov. 20, 1967).

vantage by having to compete with persons who make use of their patents without bearing, through royalties, the costs of developing them.

Appendix B of this part includes draft legislation which would accomplish the legislative recommendations that follow.

Authorization and Consent

Recommendation 4. Amend 28 U.S.C. § 1498 to make authorization and consent automatic in all cases except where an agency expressly withholds its authorization and consent as to a specific patent.

We see a need to continue the anti-injunctive aspects of 28 U.S.C. § 1498. In fact, the law should be strengthened to make it clear that authorization and consent is automatically given, with the proviso that it may be withdrawn as to specifically identified patents. We would make authorization and consent automatic in order to eliminate any doubts regarding the interpretation of these provisions given by the Comptroller General.[61] Making consent automatic except where specifically withdrawn should eliminate uncertainties in some cases as to whether there is authorization and consent. Such doubts can lead to additional contingent costs in bids.

We would, however, make it clear that agencies could specifically withdraw authorization and consent as to patents identified at the time of contracting. There are a few circumstances when this would be useful and, in any case, in the course of specifically identifying the patent, the possible effects of withdrawing authorization and consent would become clear. We reject the concept that agencies should be allowed to withdraw authorization and consent as to broad classes of contracts or items (such as supply contracts for standard commercial items). Such a policy could have substantial anticompetitive effects which would not be visible in many cases. This would be especially true where the technical specifications are such that the use of a patented invention is necessary if a responsive bid is to be submitted.

Patent Indemnity

Recommendation 5.—Amend agency regulations and clauses to provide that all contractual warranties against patent infringement be provided by specific contractual language and not by implication.

Agencies should take steps similar to those of DOD to preclude the reading of implied warranties into their contracts. Government procurement regulations and clauses should be amended to provide that all patent indemnification should be provided by specific contractual language and not by implication. Such language would tend to minimize the inclusion of contingencies for patent indenmity in bids in situations where the Government does not desire indemnity.

Administrative Settlement of Patent Claims and Acquisition of Patent Rights

Recommendation 6.—Authorize all agencies to settle patent infringement claims out of available appropriations prior to the filing of suit.

Recommendation 7.—Grant all agencies express statutory authority to acquire patents, applications for patents, and licenses or other interests thereunder.

[61] 46 Comp. Gen. 277 (1966).

Another way to facilitate appropriate monetary relief for the use of patented inventions by or for the Government is to widen administrative authority to settle claims for such use. Only the Department of Defense has clear authority in this area. We have concluded that this should be rectified and that there is a need for authority in all agencies to settle claims that could be brought under 28 U.S.C. § 1498. The granting of such authority would be a significant measure in ensuring the equitable treatment of patent owners.

Agencies should also have clear authority to acquire patents or rights thereunder. This would allow agencies to follow procedures similar to NASA's "preprocurement licensing" approach rather than relying on after-the-fact suits or settlement.

District Court Jurisdiction in Actions Under 28 U.S.C. § 1498

Recommendation 8.—Give the United States District Courts concurrent jurisdiction with the Court of Claims for suits brought pursuant to 28 U.S.C. § 1498 subject to the jurisdictional amount under the Tucker Act.

We find no sound reason for precluding the United States District Courts from jurisdiction over patent suits under 28 U.S.C. § 1498 where the amount in controversy is under $10,000. The Tucker Act, has generally given the district courts jurisdiction, concurrent with that of the Court of Claims, in suits against the Government where the amount in controversy is under $10,000.[62] We see no reason why a different standard should prevail with respect to patent litigation involving the United States. Inasmuch as we are recommending other changes in 28 U.S.C. § 1498, we believe an alignment of practice in this area with generally prevailing practice is worthwhile. It should, in a small way, better promote the possibilities of patent holders obtaining relief at a minimum cost.

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[62] In Part G, Legal and Administrative Remedies, we recommend raising the dollar level of Tucker Act jurisdiction with respect to contract matters. If that recommendation is adopted, we would also favor an increase in the jurisdictional amount for patent cases.

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